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Drivers affecting the relation between biodistricts and school meals initiatives: evidence from the Cilento biodistrict

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Biodistricts (also known as "organic districts" or "eco-regions") are receiving increasing attention by scholars and public institutions. This interest is based largely on the biodistricts' focus on linking organic agriculture with the socio-economic, cultural and ethical aspects of the areas in which they are located. Furthermore, these realities are in line with recent EU initiatives aimed at promoting sustainable practices, such as Green Public Procurement and others included in the Farm to Fork strategy. The rising awareness of sustainability, food safety and security within schools has made Public School Food Procurement (PSFP) one of the potential drivers supporting the biodistricts' development. Despite its relevance, research on this topic is relatively scarce. The present study seeks to assess the drivers influencing the integration between biodistricts and organic PSFP. A theoretical and an analytical framework tool were developed to this end and applied to the Cilento Biodistrict, where organic PSFP is currently active. The research highlighted different drivers positively affecting the access of the Cilento Biodistrict to organic PSFP, mainly related to its collaborative nature and the interest in adopting more sustainable practices. However, characteristics of local organic production such as high prices and insufficient volumes negatively impact the relationship with organic public school canteens. Considering the relatively homogeneous characteristics of these realities, the study provides a reference framework for further research and policies supporting the relationship between organic school meals initiatives and biodistricts.

KEYWORDS

school food procurement, green public procurement, organic food, biodistrict, school canteens, supply chain management, short food supply chain

1. Introduction

The production and procurement of organic food for public school canteens is attracting growing interest due to its interaction with Green Public Procurement (GPP). Organic Public School Food Procurement is a subcategory of GPP and plays a pivotal role in orienting its sustainability (Filippini et al., 2018). School canteens serving organic food raise awareness on sustainable practices not only among teachers, students and their respective families, but also among the actors involved in the food supply chain (Wahlen et al., 2012; European Union, 2018b). Various initiatives aimed at promoting the consumption of organic food in school canteens are being implemented in different Member States (ICLEI and IFOAM, 2021). In Italy, municipalities are actively engaged in promoting the inclusion of organic food in school meals,

as well as organizing initiatives to raise awareness on the subject (Maietta and Gorgitano, 2016). The role of GPP in raising awareness on sustainable agriculture practices, due to its focus on organic production and consumption, is also stressed by other authors (Risku-Norja and Løes, 2016). A positive example of sustainable rural development is represented by biodistricts (also referred to as "organic districts" or "eco-regions"), a fast-growing reality in the EU, and particularly in Italy (Sturla et al., 2019). Biodistricts focus on linking organic agriculture to the socio-economic, cultural and ethical aspects of the territories and have been regarded as one of the solutions to achieve the objectives set by the Farm to Fork strategy (European Union, 2021). Within this context, schools are considered a fundamental driver influencing the increase in consumption of organic and local food (Pugliese et al., 2016; Sturla et al., 2019). As a result, a strong link between biodistricts, GPP and Public-School Food Procurement exists (Basile and Cuoco, 2013). Despite its advantages, public school sourcing for organic food is constrained by several barriers associated to the complexities of public procurement and several characteristics specific to organic production (Sonnino, 2009; Risku-Norja and Løes, 2016; Jouzi et al., 2017). Adopting a supply chain management approach could provide a useful contribution to the analysis of the constraints affecting inter-actor relationships in the organic PSFP chain (Kretschmer et al., 2013; European Union, 2018a). Despite the relevance of this topic and the interest that biodistricts have raised among researchers, policy makers, and supranational institutions like the EU (Sturla et al., 2019), studies on the role of supply chain management involving school canteens and biodistricts are still scarce. The aim of the study is to fill this gap by providing methods to support the integration between biodistricts and organic PSFP. For the purposes of the study, the Cilento Biodistrict, widely known as a best practice in the field and the first one established in Italy (Basile et al., 2021), was selected. School canteens serving organic food in Vallo della Lucania, one of the municipalities involved in the Biodistrict, were analyzed as subject of the study. A theoretical framework, aimed at defining the most influencing factors affecting organic PSFP chains and describing the Cilento Biodistrict, is presented in the first part of the research. Based on the theoretical framework, a questionnaire was developed and administered to actors involved in the Biodistrict organic food production and in the organic school meals program.

2. Theoretical framework

The first part of the study consists of a literature review on the factors influencing organic PSFP and the characteristics of biodistricts. Relevant online academic databases and library archives like Scopus and Google Scholar were consulted from July 11th to October 29th 2022. Several key terms such as "eco-regions," "organic districts," "biodistretti," "biodistricts," "organic school meals"; "green public procurement"; "sustainable food chains" "sustainable food systems"; "school food procurement"; "public food procurement" were combined using the operators "AND" and "OR." The resulting papers were filtered according to the consistency of the titles and abstracts with the objectives of the study. Additional paper selection was based on content relevance, the frequency of quotations and the date of issue. Three fundamental SCM dimensions for organic PSFP emerged from the literature review: (i) institutional relationships, (ii) legal/contractual conditions, and (iii) spatial and logistics management (Kretschmer et al., 2013; European Union, 2018b). In addition to academic papers, reports on biodistricts deemed as relevant for the study were consulted, when necessary. The results of the literature review supported the definition of the analytical framework, the empirical assessment method, and the data collection procedure.

2.1. Institutional relationships

The institutional dimension influences the relationship between supply chain actors and the resulting level of collaboration. Commitment, shared vision, level of information sharing/asymmetry and trust (Fawcett et al., 2008; Mikkelsen and Sylvest, 2012; Galli et al., 2014; European Union, 2018b; Teniwut et al., 2018) are regarded as the most influencing factors within the dimension. Commitment and a shared vision on the benefits of green procurement are considered basic conditions for productive collaboration in organic food supply chains (Mikkelsen and Sylvest, 2012; Galli et al., 2014; European Union, 2018a). Mechanisms of inclusion such as roundtable discussions among local public authorities and organic food suppliers have been recognized as effective methods to increase engagement and subsequently develop a more aligned vision among actors (European Union, 2018a). Given that food supply chains are often hampered by missing or undisclosed information on benefits (e.g., quality and safety) and costs (Hobbs, 2004; Minarelli et al., 2016b), information exchange is also a fundamental condition, since it supports transparency and discourages opportunistic behavior (Louro et al., 2017). In this regard, inter-party trust is a fundamental driver of information sharing, since the former motivates parties to exchange relevant data (Teniwut et al., 2018). These conditions are particularly relevant in the case of school meals supply chains, which are particularly long and complex due to the usual decentralization of decisions to local authorities[1] (Louro et al., 2017). Complexities are emphasized in the case of organic PSFP, since it also involves the engagement of political and economic supranational institutions (e.g., the EU), policymakers and inspection services (Djekic et al., 2021). As a result, the number of supply chain actors increases (Louro et al., 2017), all of which intensifies complexity and ultimately leads to information asymmetry issues (Minarelli et al., 2016a; Chrisidu-Budnik and Przedańska, 2017; Pietrzak et al., 2020). Farmers are usually the category with the lower bargaining power and access to information (Pietrzak et al., 2020). Nevertheless, since information asymmetry and opportunistic behavior can also take place on the farmers' side, some authors highlight the need to avoid imperfect information independently from the responsible party (Minarelli et al., 2016a).

Abbreviations: EU, European Union; GPP, Green Public Procurement; OC, organic certification; PSFP, Public School Food Procurement; SCM, supply chain management; SFSC, short food supply chain.

1 School meals supply chains usually involve: farmers, processors, distributors, public administration institutions (e.g., municipalities) and catering companies (Filippini et al., 2018; European Union, 2018b; Djekic and Tomasevic, 2020).

2.2. Legal/contractual conditions

School food procurement is governed by a combination of general criteria established at the European Union level and more specific aspects determined by national and local provisions (Krivašonoka, 2017; Louro et al., 2017; European Union, 2018a). The EU requires a certification to ensure the quality and integrity of organic products (Leitner and Vogl, 2020), which should comply with regulations on the food industry (e.g., Regulation EC No 178/2002, also known as General Food Law[2]) and Green Public Procurement criteria[3] (Harris, 2008; Boyano et al., 2019). Nevertheless, since specific requirements do not exist, they must be defined by each Member State' s national or regional body (Veldstra et al., 2014; Leitner and Vogl, 2020). The lack of common standards, and the number of requisites to satisfy, increase the complexity of the transactions. For instance, producers struggle to adhere to the large number of entry requirements established by the organic certification (Harris, 2008; Jouzi et al., 2017; Boyano et al., 2019; Leitner and Vogl, 2020). The impossibility of using certain inputs and treatments is often recognized as a barrier that lowers yields and productivity (Jouzi et al., 2017; Leitner and Vogl, 2020). The costs related to monitoring and documenting infrastructures are a further aspect limiting the adoption of the OC, especially by small farmers (Jouzi et al., 2017; Boyano et al., 2019; Leitner and Vogl, 2020). Another related barrier is the three-year transition period, i.e., the timespan in which producers are required to adopt organic practices but cannot obtain organic price premiums (Oberholtzer et al., 2005). Several producers are also prevented from entering the certification process due to a widespread belief that the benefits and organic premium prices conferred by the certification do not compensate its cost (Oberholtzer et al., 2005). In fact, organic farmers tend to incur in higher operating costs compared to conventional ones, especially in relation to equipment and substitutes for synthetic plant treatments (Jouzi et al., 2017). These issues are not only unfavourable for producers, but for the other actors of the supply chain as well. For instance, the extra time, bureaucracy, and subsequent workload needed to plan and sign organic food procurement contracts are perceived, together with the price issues, as a challenge by numerous contractors (Mikkelsen and Sylvest, 2012). In this regard, group certification[4] could play an important role in facilitating small farmers' access to organic markets. In particular, Regulation (EU) 2018/848[5] recognizes it as a system that reduces the burden of inspection costs for individual farmers as well as an important tool to strengthen local networks. As a result, it could promote local supply chains and also lead to a spill-over effect on other local economic activities (ICLEI and IFOAM, 2021). Another widely debated topic on the legislative boundaries of food procurement is the possibility for public authorities to preferably buy from local producers. This contrasted with Directive 2014/24/EU, which underlines that public procurement should comply with the Treaty of the (European Union, 2014). The Treaty bans anti-competition procurement, in this case the preference for local suppliers, since the EU promotes trade among all Member States (Krivašonoka, 2017). Statements by EU authorities claiming that Member States may encourage local and short supply if they wish, have contributed little to solve this ambiguity; in this regard, ICLEI and IFOAM (2021) urges the European Union to clarify its position on local/regional procurement, consider regional food economies in procurement criteria and find a balance between local producers and inter-Member State trade. Interestingly, some countries have managed to favor regional suppliers by means of national laws or amendments. ICLEI considers the implementation of the Farm to Fork strategy as an essential source to foster the consumption of local products; in fact, the application of the initiative could connect several stakeholders (e.g., public canteens and small-scale farmers) at the regional level by means of short supply chains (ICLEI and IFOAM, 2021). Italy has legalized the restriction of the participation in a public competition to companies based in the province of the tender (citation reported in Morgan and Sonnino, 2006). By doing so, the Italian legislation has emphasized the strong relationship between food and local culture and "the territorial *rootedness* of the school meal service over and above the European principle of *non-discrimination*" (Morgan and Sonnino, 2006, p. 22). Along with short supply chains, the division of contracts into lots is recognized as one of the most important sources of pre-procurement market engagement of local producers (ICLEI, 2022a). Splitting large public contracts allows small operators to compete in the market (ICLEI, 2022b), which would otherwise not be attainable given their impossibility to satisfy demand for large volumes for small producers (Sonnino, 2009; Krivašonoka, 2017). Finally, focusing the focus on seasonality, local culinary traditions and biodiversity (e.g., procure different varieties of the same product) contribute to supporting the development of short food supply chains (Filippini et al., 2018; ICLEI, 2022b). Price issues are among the biggest obstacles to the implementation of organic procurement (ICLEI and IFOAM, 2021). In fact, organic products are more expensive due to the price premiums applied (Pawlewicz, 2020), which vary based on the type of food. They usually exceed the ones that apply to conventional food by "[…] 5–30% for milk and dairy products, 5–60% for cereal products, 20–82% for eggs, 60% for carrots and onions, and 40% for potatoes" (Pawlewicz, 2020, p.1). Prices are even higher in the case of small/ local farmers due to the diseconomies

2 By addressing important safety concepts (e.g., traceability, labelling, and food operators' responsibilities). in food supply chains, the General Food Law provides a baseline reference for national regulations on school meals ensuring that only safe food is placed on the European Union market (European Union, 2002; Louro et al., 2017).

3 GPP criteria, included in Directive 2014/24/EU, ensure that tendering procedures and contracts are carried out according to sustainability and environmental standards. Supplementary Table 1 lists the criteria, their definition and the related articles in the Directive.

4 In group certification systems, individual producers form organizations with an intermediary role between smallholders and certification agencies (Harris, 2008; Yu and He, 2021). These mechanisms are based on an Internal Control System (ICS), i.e., single persons or bodies within the certified operators are in charge of periodic inspections of individual farmers (Ghedira et al., 2020). The certificate shall be withdrawn for the whole group of farmers in case of detection of deficiencies in the ICS, e.g., failure to identify non-compliance by individual members (European Union, 2018b).

5 Regulation (UE) 2018/848 has legally recognised the concept of "group certificate" and "group of operators"; furthermore, since 1st January, 2021, the latter has been allowed in Member States, while until then it was only permitted in developing countries (European Union, 2018b; Ghedira et al., 2020; IFOAM, 2022).

of scale increasing their costs of production (Krivašonoka, 2017). As a result, organic food is usually less accessible and affordable compared to that from conventional farmers and bigger wholesalers (Krivašonoka, 2017; Pawlewicz, 2020). Nevertheless, since the market is opened to all producers (European Union, 2016), local/small farmers must compete with actors that are more productive and offer better price options, which usually leads public authorities to prioritize the latter (Krivašonoka, 2017). This problem, in turn, is primarily caused by the financial pressure that governs public procurement, in which buying authorities are often forced to adopt the lowest possible price criterion rather than the MEAT[6] (Lehtinen, 2012). This is precisely the case with school meals, constrained by extremely tight budgets (Izumi et al., 2010, p. 336), As a result, the focus is often on the achievement of low costs rather than on food quality and sustainability (Izumi et al., 2010).

2.3. Spatial/logistic management

Organic food supply chains are subject to logistic challenges which highly influence their efficiency (Gebresenbet and Bosona, 2012; Mikkelsen and Sylvest, 2012; Jouzi et al., 2017). An issue common to all food products is perishability, which requires produce to be managed through unbroken cold chains, strategic location of logistic platforms and highly efficient transport processes to maximize their shelf life and quality (Maiellaro et al., 2019). In addition, several characteristics specific to organic food negatively influence productivity. Regulations on organic farming heavily restrict the use of plant treatments (e.g., fertilizers and pesticides); as a result, organic produce is usually more subject to variability and exposed to external interferences, such as the unpredictable effects of climate change (Jouzi et al., 2017) and "the yields of organic farms are around 25% lower than conventional farms" (Jouzi et al., 2017, p. 146). A further source of uncertainty is the relatively limited product range of organic products (Krivašonoka, 2017), which often forces procurement authorities to resort to conventional and non-local food platforms (Sonnino, 2009; Risku-Norja and Løes, 2016; Krivašonoka, 2017). The level of centralization is a further aspect influencing the logistics of PSPF. Centralized models[7], characterized by a restricted number of suppliers scattered across relatively large areas, require sophisticated coordination processes and distribution systems aimed at managing long distances (Kretschmer et al., 2013; Baldi, 2014). A high level of centralization is also believed to undermine the relationship with local/small producers, which face entry barriers due to the difficulty to align with the complexity of large public sector contracts (Baldi, 2014). Ultimately, the standardized practices involved in centralized PSFP are deemed to be unable to satisfy the diverse needs of different schools (Baldi, 2014). In decentralized models[8], on the other hand, distances are shorter (Baldi, 2014) and the logistics apparently less complex. However, these models require municipalities/schools to directly deal with all the procurement activities (e.g., ordering, collecting, storing) that would otherwise be performed by catering companies; this aspect inevitably increases the technical and administrative burden for procuring authorities (Izumi et al., 2010), which usually resort to catering companies for specific activities related to school food procurement (Filippini et al., 2018; Bruckmayer et al., 2021). This is also the case of Italy, a country in which municipalities delegate the relationships with producers to contractors (Filippini et al., 2018). Proximity between urban and rural areas is another aspect of interest in logistic management. In fact, territorial alignment between organic products supply and demand makes public procurement less complex and less subject to supply chain disruptions (Caputo et al., 2017). Furthermore, proximity is believed to favor consumption of local food since it allows buyers to have more information on the origins of products; moreover, purchasers are more prone to buy local food since it is perceived as closer to the culture and food identity of the place they live in (Galli et al., 2014). As a result, proximity favors the access to urban areas, both in relation to the reduced distance as well as to the enhanced customer trust and satisfaction. Nevertheless, a main constraint to organic farmers' supply to urban markets is represented by the relatively large volumes demanded by urban institutions (e.g., school canteens), which local producers are often unable to satisfy (Sonnino, 2009; Krivašonoka, 2017).

2.4. Overview on biodistricts, the Cilento biodistrict and the school meal program

Experts in the field agree on generally describing a biodistrict as "a geographical area where farmers, citizens, tourist operators, associations and public authorities enter into an agreement for the sustainable management of local resources, based on organic production and consumption" (Basile and Cuoco, 2013, p.2). This definition is included and further detailed in the EU Organic Action Plan: "….The aim is to maximize the economic and sociocultural potential of the territory. Each 'Bio district' includes lifestyle, nutrition, human relations and nature considerations. This results in local agricultural production that is appreciated by consumers and hence has a higher market value" (European Union, 2021). The organic identity of biodistricts (Pugliese et al., 2016) involves the creation of new forms of governance and the economic, social, cultural and ethical development of the areas in which they are located (Sturla et al., 2019; Zanasi et al., 2020; Basile et al., 2021). As a result, by fostering multiple activities linked to organic farming (e.g., supplying organic food to public canteens and restaurants, direct selling and fostering agri-touristic activities), they exactly match the objectives set by Green Public Procurement (Pugliese et al., 2016; European Union, 2023). So far, the classification of biodistricts is in a transitional stage. At the moment, the most advanced piece of legislation is provided by

6 MEAT stands for 'most economically advantageous tender', a criterion which takes into account price, quality, social and environmental aspects in the choice of a tender (European Union, 2014; Louro et al., 2017; Boyano et al., 2019).

7 Models in which procurement is carried out by a central (e.g., regional or national) body, which has responsibility to select a restricted number of contractors, negotiate on prices and quality and organize food distribution and transportation (Kretschmer, et al., 2013; Maietta and Gorgitano, 2016; Filippini et al., 2018).

8 Models in which procurement is carried out by local units (e.g., municipalities or single schools), which usually rely on local suppliers (Baldi, 2014).

the EU Organic Action Plan, which provides a general reference according to which the legal definition of biodistricts must be specified by each Member State (National Organic Action Plans) starting from 2023. One of the common features for legal reconnaissance is the presence of a relevant share of organic producers and other actors involved in the local organic production (Sturla et al., 2019; Assiri et al., 2021; Basile et al., 2021). This share must be defined in detail national and regional governments. At a global level, a prevailing definition of the biodistricts, not involving specific set of standards, follows the definition provided by the International Network of Ecoregions, which substantially mirrors the EU Action Plan (Basile, 2020).

Biodistricts are characterized by a dense network of public and private entities (Basile and Cuoco, 2013) where local producers represent a pivotal category, since activities revolve around farming (Basile and Cuoco, 2013). Moreover, producers highly benefit from being part of a biodistrict, given that they are more supported when it comes to raising legal and economic issues, such as the complexity of organic standards and norms (Pugliese et al., 2016). Local authorities are regarded as another key group of stakeholders. Their participation varies depending on the biodistrict. For instance, some municipalities support it not only from a logistic point of view but with more direct economic and legal initiatives, e.g., by restricting the use of pesticides in all municipal areas and by favoring organic producers and firms during tenders for public canteens. These institutions are also fundamental when it comes to the promotion of the biodistrict, e.g., by supporting initiatives aimed at school canteens, health facilities and other public organizations (Basile and Cuoco, 2013). From a structural point of view, the existence of the biodistricts is strongly linked to the collaboration with various networks often aimed at the transformation, commercialization, and business management of the organic food chain (Sturla et al., 2019). The highly collaborative nature of biodistricts is confirmed by the organization of forums where farmers, public authorities and other economic stakeholders meet and jointly discuss how to achieve the objectives of the local short supply chains (Basile and Cuoco, 2013). Beneficiaries of initiatives and products from the biodistricts involve public canteens (e.g., schools and nursing homes), organic food stores, restaurants and direct consumers (Basile and Cuoco, 2013; Pugliese et al., 2016; Sturla et al., 2019). Thanks to the proximity to local producers, i.e., to SFSCs, buyer–supplier relationships are usually characterized by a high level of trust, which results in inter-party cooperation (Basile and Cuoco, 2013). Experts in the field and international organizations agree on defining the development of shared projects with schools as one of the major opportunities to create new networks as well as raise awareness on sustainability (Basile and Cuoco, 2013). Current forms of collaboration with schools involve food education projects and laboratories to educate on environmental, agricultural and cultural issues. Nevertheless, one of the most promising and discussed development fields is the supply to school canteens (Sturla et al., 2019). In this regard, several biodistricts are already involved in such activities. The Cilento organic district collaborates with school canteens from the surrounding municipalities by means of promotional and education activities, such as laboratories on proper nutrition, activation of green canteens and other public procurement initiatives (Pugliese et al., 2016) with the Cilento Biodistrict considered as a reference model for the creation of other similar realities (Basile et al., 2021). It is the first multi-sectoral European biodistrict, involving diverse and related activities, such as: agriculture, environmental protection, social initiatives, tourism and gastronomy (Pugliese et al., 2016). Within the Cilento Biodistrict context, in the Municipality of Vallo della Lucania, a program for the development of a school canteen started in 2019; specific information is not publicly available at the moment. By interviewing the representative of the Municipality, before the data collection, it turned out that the initiative started in 2019. A School Canteen Commission representing the main stakeholders was created for the school meal management; it involves one employee from the Municipality (appointed by the Mayor), two parents' representatives from the Municipality Kindergartens, three parents' representatives from the Municipality Primary School, two teachers' representatives from the Kindergartens, two teacher representatives from the Primary School, one expert Nutrition consultant (chosen by the Municipal Administration) and one representative of the catering company. In total 350 meals are served every day. Around 50% of the ingredients are organic. The conventional ingredient are locally supplied (0 miles) with the exception of meat, fish and fresh vegetables. Difficulties in increasing the share of organic ingredients emerged in relation to the Biodistrict local supply. The analysis of the factors influencing the development of organic school meals programs in biodistricts considering the case of the Vallo di Lucania Municipality, within a fully developed biodistrict like the Cilento one, can provide useful insights not to tackle the specific case study challenges, but also for the development of comparable initiatives in similar realities.

3. Materials and methods

3.1. The analytical framework

The first step in the definition of the methodology consisted in the development of an analytical framework which, based on the literature review, aimed at providing the conceptual base for the creation of the questionnaire. The three general dimensions (institutional, legal/contractual, spatial/logistic) influencing organic PSFP identified by the European Union (2018a) and Kretschmer et al. (2013) and the specific categories affecting the three dimensions were first considered. In a second step, the SCM drivers influencing the three general dimensions were defined: *Collaboration*, *Entry Barriers*, *Contract Characteristics*, *Responsiveness* and *Collaboration* (see sections 3.1.1, 3.1.2, 3.1.3). Tables 1–3 link each question and dimension with their respective drivers and category; the literature review references, motivating the choice of the different questions, are also specified. Table 4 depicts the rationale behind the analytical framework by including the three different levels of analysis.

3.1.1. Institutional relationships

The factors related to the institutional dimension (section 2.1) were considered first (see Table 1). Question 1 *(Q1)* analyzed the influence of a shared vision, level of commitment and trust on the parties' willingness to collaborate. According to various authors (Pugliese et al., 2016; Sturla et al., 2019; Basile et al., 2021) these aspects positively influence the performance of biodistricts. Question 2 (*Q2*) aimed at evaluating to which extent sensitive information (costs, quality and safety) is shared (see Table 1). Assessing the level of information sharing among organic district actors is fundamental due to the dependence of these realities on various networks (see section

TABLE 1 Summary analytical framework for the *Institutional relationships* dimension and the *Collaboration* driver.

N.	Question	Category	References
Institutional relationships - collaboration			
1	How do the following conditions affect supply chain members' willingness to collaborate? (Shared vision on environment, sustainability and organic production; same level of commitment; trust)	Incentive alignment	European Union (2018a); Teniwut et al. (2018); Galli et al. (2014); Mikkelsen and Sylvest (2012); Basile et al. (2021); Sturla et al. (2019); Pugliese et al. (2016)
2	How much information is shared along the supply chain? (If possible, indicate what type of info is/is not normally shared, e.g.: costs, risks, benefits, quality...)	Incentive alignment	Minarelli et al. (2016b); Basile and Cuoco (2013); Simatupang and Sridharan (2005); Hobbs (2004)
3	On average, to which extent are decisions taken by mutual agreement among members? If possible, indicate which decisions are taken jointly	Decision synchronization	European Union (2018a)
4	Are there discussion mechanisms among members (e.g.: meetings between suppliers and institutions) to raise issues and find shared solutions?	Decision synchronization	European Union (2018a)
5	Do you think that all members of the supply chain have the same level of information? If possible, indicate which actors have the greatest and which the lowest number of information	Information sharing	Pietrzak et al. (2020); Minarelli et al. (2016a)
6	Do actors, overall, have the same bargaining power (e.g., no dominant actors in decision making) in the supply chain? If possible, indicate which type of governance / organization exists within the supply chain	Information sharing	Pietrzak et al. (2020); Sturla et al. (2019)
7	In view of the above (shared vision, trust, level of information sharing, mechanisms for joint solutions) are you satisfied with the level of collaboration achieved? Do you think it should be improved? If yes, how?	Satisfaction level towards collaboration	Based on the conditions in Q. 1–6

2.4). As a result, a correct flow of information is paramount for the efficiency of the school meal supply chain. Questions 3 *(Q3)* and 4 *(Q4)* related to the level of decision-sharing and whether discussion mechanisms to achieve shared solutions exist. As for *Q1*, these concepts are significant given the importance of collaboration among actors in biodistricts. Furthermore, this question assessed whether meetings aimed at engaging local farmers, authorities, and other economic stakeholders exist within the Biodistrict. Questions 5 *(Q5)* and 6 *(Q6)* investigated the level of information available to the parties, and how it affects their bargaining power, respectively. *Q6* also built upon the concept of contractual power to identify the type of governance in the Biodistrict. Analyzing the governance structure is significant since, as mentioned by Sturla et al. (2019), it allows to understand whether these models can involve all stakeholders, even those that are usually not directly engaged in the management of the Biodistrict. The seventh question *(Q7)* consisted of an overall assessment of the level of collaboration within the supply chain, and sought to encourage suggestions from respondents on how this aspect should be improved. As shown in Table 1, all the conditions related to the institutional dimension were linked to the *collaboration* driver, since it is defined as a driving factor for strengthening supply chain networks (Teniwut et al., 2018). According to Simatupang and Sridharan (2005), collaboration occurs when supply chain members create competitive advantage through information sharing, decision synchronization and incentive alignment. The first one entails the extent to which relevant information is both disseminated and captured, which determines the level of information available to each member, precisely the topic of *Q5*. In turn, information sharing levels, as mentioned above, have a strict relationship with bargaining power, an issue considered in *Q6*. The second component of collaboration is related to the level of joint decision-making in the supply chain, as addressed in *Q3* and *Q4*. The third component measures the degree to which supply chain stakeholders share costs and benefits (e.g., quality); this topic is directly related to *Q2*, which considers some of the aspects that Simatupang and Sridharan (2005) relate to the incentive alignment sphere. These authors also include risk sharing as a component of incentive alignment; therefore, this aspect was included among the examples of possible information to be disclosed.

3.1.2. Legal/contractual conditions

A second set of questions sought to evaluate the influence of legal/contractual aspects (section 2.2) on the case study (see Table 2). *Q8* analyzed the Biodistrict's level of difficulty in aligning to the variety of standards demanded by organic PSFP. *Q9* focused on specific aspects related to *Q8*, i.e., how the complexity of the rules, and the time and labor needed to implement PSFP contracts, prevents the Biodistrict's members from entering school meals programs. Questions *10–13* specifically referred to organic food suppliers. *Q10* explored the impact of various challenges related to the organic certification (e.g., number of requisites to be satisfied, level of support from organic associations, operating costs and length of the transition period), while *Q11* aimed at understanding whether the costs for

TABLE 2 Summary analytical framework for the *Legal/contractual conditions* dimension and *Entry barriers* driver.

N.	Question	Category	References
Legal/contractual conditions – entry barriers			
8	How difficult is it for the organic district to align with the requirements and certifications demanded by public schools/European Union when dealing with organic PSFP? Indicate, if possible, which certifications and requirements are required/allowed	Legal/contractual alignment	Krivašonoka (2017); Louro et al. (2017); European Union (2018a)
9	How much does the higher amount of time, work and bureaucracy needed to sign contracts for organic food discourage the members of the supply chain?	Organic food contracts related issues	Mikkelsen and Sylvest (2012)
10	To which extent do the issues related to the organic certification (entry requirements, bureaucratic procedures, costs...) discourage participation by producers? Indicate, if possible, which are the main causes of non-participation (e.g.: variety of requirements to be met, lack of support from producer associations, operating costs, three-years transition period...)	Organic certification related issues	Leitner and Vogl (2020); Boyano et al. (2019); Jouzi et al. (2017)
11	Are the costs for an organic producer substantially higher compared to conventional producers? Which are the most influential expenses (e.g.: equipment, substitutes for conventional treatments...)?	Costs of organic production	Jouzi et al. (2017)
12	How does Directive 2014/24/EU (according to which tenders must be open to all Member States) affect small producers' accessibility to markets? Indicate, if possible, whether mechanisms to facilitate the inclusion of local producers exist (e.g.: contract division into lots, focus on seasonal products, group certification etc.)	Legislative support to the inclusion of local farmers (localness issues related to Directive 2014/24/EU)	ICLEI (2022a); ICLEI (2022b); ICLEI and IFOAM (2021); Filippini et al. (2018); Krivašonoka (2017); Morgan and Sonnino (2006)
13	How much do lower margins (in public procurement, the gain for producers is normally less compared to other sales channels) and longer payment times affect small producers' willingness to cooperate to public procurement initiatives?	Price and payment times public procurement	Izumi et al. (2010); Mikkelsen and Sylvest (2012)
14	How important is the premium price of organic products in the choice between conventional and organic producers? List, if possible, which aspects between price, quality and sustainability are most considered by the producers	Price premiums on organic food	Krivašonoka (2017); Filippini et al. (2018); Izumi et al. (2010)
15	Are school-biodistrict contracts normally short- or long-term oriented?	Contract duration (definition of producers-clients relationship solidity and related transaction costs)	Hobbs and Young (2000)

farmers in organic districts are significantly higher compared to conventional producers. Furthermore, it helped to define the costs determining the difference between organic and conventional production. *Q12* concerned the provision on local production contained in Directive 2014/24/EU and its impact on the local producers' accessibility to markets. Furthermore, it assessed whether inclusion mechanisms, such as increased focus on seasonality (Filippini et al., 2018; ICLEI, 2022b), contracts division into lots (ICLEI, 2022a) and mechanisms of group certification (ICLEI and IFOAM, 2021) are in place to favor local farmers' access to PSFP. *Q13* and *Q14* explored the contractual aspect of price. *Q13* analyzed how the lower prices usually paid by institutions, the bureaucracy involved and the subsequent longer payment times, influence the organic producers' willingness to collaborate to public procurement initiatives. Since the focus of PSFP is usually on achieving the lower costs due to budget constraints while the emphasis in biodistricts revolves around organic production and sustainable practices, question 14 was used to assess whether the relationships established with the Biodistrict encourage buying authorities to prioritize sustainability over prices. *Q15* was not strictly related to legal/contractual burdens but aimed at understanding the average duration of contracts, i.e., whether they are more oriented towards the short or long term, which has several implications that go beyond the contractual dimension. The length of a contract usually plays a role in defining the relationship among the parties involved; for instance, long-term contracts usually imply a stronger relationship between producers and their clients, while short-term agreements might indicate a lower level of commitment between the two, involving, among other things, potentially higher transaction costs (Hobbs, 2004), which can undermine the overall efficiency of the supply chain. The topics addressed in the legal/contractual dimension were considered as determinants of entry barriers to organic PSFP to the different actors involved. This perspective is supported by several scholars: Mohseni et al. (2022) precisely include regulatory factors among the barriers to sustainable food supply chains. This view builds upon the work of Meijer et al. (2019) and Del Borghi et al. (2014), which specifically state that unawareness or failure to align with organic standards constitutes an internal barrier and brings further complexity to food supply chains. The latter authors' findings are in line with previous studies, such as that of Lehtinen (2012) which refers to the organic certification as a barrier to entry, due to the transition period and the standards involved.

3.1.3. Spatial/logistic management

The last set of questions analyzed the influence of spatial/logistic factors on PSFP performances (see Table 3). *Q16* to *Q19* focused on strictly spatial aspects. *Q16* and *Q17* specifically dealt with the level of procurement decentralization and the assessment of the stakeholders involved in the procurement phase (e.g., whether local authorities' resort to intermediaries). Two questions described how the organizational structure of PSFP impacted logistic efficiency. In particular, *Q18* considered the producers' access to logistic platforms; *Q19* investigated how different drivers related to the proximity of a biodistrict to urban centers influence the access to schools (e.g., the perception of buying local and more genuine food as well as its consequences, such as the positive impact on logistic organization). *Q20* to *30* assessed the influence of different characteristics of organic production on the satisfaction of school canteens demand and on management logistics. Questions 20 to 23 analyzed the impact of characteristics specific to organic food. Question 20 assessed to which extent productivity is affected by the limitations in the use of pesticides. Question 21 dealt with another characteristic considered as a risk factor for productivity, i.e., supply variability. Question 22 considered whether the relatively limited products' range supplied by organic agriculture, compared to traditional methods, is a barrier to entry in PSFP. Question 23 investigated how the limited products' range influences complexity and uncertainty in the supply chain. According to Risku-Norja and Løes (2016) and Sonnino (2009), local organic production is usually not capable of totally meeting demand from schools (all of which often forces local institutions to resort to non-local platforms). *Q24* to *28* were introduced to further investigate this issue. *Q24* considered whether the quantity of food produced by the organics district, based on its productivity, product range and variability, is sufficient to satisfy school demand. *Q25* and *Q26* investigated, respectively, whether the characteristics of organic production influence the Biodistrict responsiveness to changes in demand (*Q25*) and other exogenous factors (*Q26*). The last two questions (*Q27* and *Q28*) analyzed timeliness of supply in terms of transport, information transfer and delivery, since they dealt with spatial aspects that influence timeliness and supply chain efficiency.

Questions 20 to 28 were focused on to coordination. According to Hobbs and Young (2000) coordination depends on three interrelated factors: product characteristics (e.g., perishability), transaction characteristics (i.e., quantity, timeliness, price etc.) and transaction costs. The higher the transaction costs, the higher the necessity to coordinate the relations within the supply chain. Questions from 20 to 28 considered this in the context of organic food supply chains. As a result, Q20 dealt with a condition that describes the specific characteristics of organic products supply, i.e., variability and product range (*Q21* and *Q22*). *Q23* analyzed the link between product characteristics and transaction characteristics. It investigated how the conditions mentioned in *Q20*, *21* and *22* influence transaction complexity, price and uncertainty and which party involved in the transaction are affected. *Q24* to *28* analyzed other transaction characteristics such as: quantity (*Q24*), flexibility (*Q25*, *Q26*) and timeliness (*Q27* and *Q28*). Lastly, *Q30* sought to defining whether transaction costs, as a result of information asymmetry, exist (Hobbs and Young, 2000; Hobbs, 2004). *Q29*, an introductory question to Q30, assessed whether control mechanisms to mitigate issues related to information asymmetry are necessary or not.

3.2. Data collection

The following steps characterized the data collection and the assessment method definition. The questionnaire testing, and validation were supported by the President and Director of the Biodistrict, by the founder and former general secretary, now Honorary President of the Biodistrict and by the Vice-Major of Vallo della Lucania, coordinator of the school meal program. The choice of the respondents derived from a preliminary consultation with the stakeholders involved in both the school meals program and the Cilento Biodistrict. The stakeholders' identification was performed by interviewing the coordinator of the school meal program within the Municipality of Vallo della Lucania. The criteria for the selection of the respondents where those of representativeness[9] and expertise,[10] which contributed to an exhaustive analysis of the case study. The respondents included spokespersons of the Vallo della Lucania Municipality, the Municipality School Canteen Commission and organic producers from the Biodistrict. Data were collected by means of semi-structured interviews carried out in the form of online video-calls. Interviews were recorded with the participants' consent. The comments made by the respondents allowed to better understand and interpret the meaning of the score provided to each question.[11] The scoring method was based on a five-point Likert scale where 1 = to not at all; 2 only a little 3 = moderately 4 = much 5 = very much. The integration of both qualitative (comments) and quantitative (scores) answers provided a better interpretation of the results by fostering the motivations behind each score, and revealing possible interactions among the different drivers. Most questions were answered by all the respondents. As expected, their level of knowledge varied based on their role, and to the category of stakeholders they represented.

4. Results

4.1. Institutional relationships

The results obtained showed the important role played by a shared vision, commitment, and trust *(Q1)* in defining the actors' willingness to collaborate (see Supplementary Table 2; Figure 1). Responses related to the level of information sharing (*Q2*) reported a surprisingly high level of risks, costs and benefits sharing. This aspect was

9 The *Representativeness* criterion was based on the consideration of respondents who represented the main actors involved in organic PSFP within the Municipality. Their answers, in fact, covered the most significant issues involved in the creation and implementation of the Organic school meal chain in Vallo della Lucania.

10 The *Expertise* criterion was based on the consideration of respondents with a deep knowledge of the history and the procedures related to the creation and implementation of the Organic school meal program; their responses provided the best possible breadth and depth in the answers to the questionnaire.

11 Respondents were not directly asked to assign a score, since it was deemed as restricting and unfavorable for their argumentations. However, by recalling the interviewees' qualitative answer through the recordings, it was possible to understand the level of influence attributed to each condition and thus assign a score.

TABLE 3 Summary analytical framework for the *Spatial/Logistic management* dimension and *Responsiveness* and *Coordination* drivers.

N.	Question	Category	References
Spatial/logistic management – responsiveness			
16	What is the degree of centralization of procurement? If possible, indicate if logistical issues related to the level of centralization exist	Centralization level of procurement	Kretschmer, et al. (2013); Baldi (2014); Filippini et al. (2018)
17	How direct is the relationship with producers?	Centralization level of procurement	Kretschmer, et al. (2013); Baldi (2014); Filippini et al. (2018)
18	Can producers access appropriate logistics platforms?	Adequacy of logistic platforms	Maiellaro et al. (2019)
19	Does the proximity of the organic district to urban centers/schools facilitate access to them? If yes, indicate what are its main drivers (e.g., perception by schools to consume local and "close" food, thus more genuine) and consequences (e.g., simpler logistics organization...)	Urban–rural proximity	Caputo et al. (2017)
Spatial/logistic management – coordination			
20	Q20: Is the biodistrict capable of overcoming productivity issues due to the impossibility of using pesticides/treatments/ preservatives? (1: not at all; 5:absolutely yes)	Product characteristics	Leitner and Vogl (2020); Jouzi et al. (2017)
21	Is the biodistrict, given the variability of organic production, capable of satisfying school demand?	Product characteristics	Jouzi et al. (2017)
22	Is the supply from the organic district able to cover the product range required by school canteens? Indicate, if possible, if you think that the range of products offered by the biodistrict is more limited than that from traditional agriculture	Product characteristics	Krivašonoka (2017)
23	What are the effects of product characteristics on transaction characteristics in terms of complexity, price, uncertainty for buyers/suppliers/both…?	Product characteristics – influence on transaction characteristics	Hobbs and Young (2000)
24	On average, does the amount of food produced by a biodistrict meet school demand? Indicate, if possible, whether you consider that organic supply is not sufficient compared to that from traditional agriculture	Transaction characteristics	Sonnino (2009); Risku-Norja and Løes (2016)
25	Is the supply chain able to adapt to changes in demand (e.g., schools require more quantity of products)?	Transaction characteristics	Leitner and Vogl (2020); Jouzi et al. (2017); Krivašonoka (2017)
26	Is the supply chain prepared to respond to external changes?	Transaction characteristics	Reported in Jouzi et al. (2017)
27	Do transport infrastructures guarantee a fast and efficient transmission of products and information?	Transaction characteristics	Maiellaro et al. (2019)
28	Is delivery from suppliers timely?	Transaction characteristics	Maiellaro et al. (2019)
29	Are control mechanisms to mitigate the problems caused by information asymmetry unnecessary? If so, indicate which control tools are in place	Transaction costs	Minarelli et al. (2016a)
30	Has the supply chain under study been able to overcome the transaction costs related to asymmetry of information? If so, which ones (e.g.: research costs; costs of screening/monitoring other actors...) are present?	Transaction costs	Fawcett et al. (2008); Hobbs (2004); Hobbs and Young (2000)

attributed to the presence of short food supply chains, which increase the level of transparency thanks to the establishment of more direct inter-party relationships among the chain actors, all of which discourages opportunistic behavior. Other categories like the homogeneity in the level of information available per member *(Q5)* as well as the absence of significant disparities in bargaining power among actors (Q6) confirmed the high level of transparency achieved. On the other hand, respondents reported that not every decision results from mutual agreement among members *(Q3)*. Nevertheless, this aspect was not attributed to a disparity in terms of bargaining power. On the contrary, interviewees perceived it as a difference in the members' levels of knowledge on specific matters, which, in turn, was viewed because of the different positions they hold. As a result, the different level of knowledge was not recognized as affecting the level of collaboration, but the result of a natural division of responsibilities. Participation is encouraged through regular meetings organized among producers, local institutions, and catering companies *(Q4)*. Overall, the high score obtained in all the *Collaboration* driver's

TABLE 4 Analytical framework structure.

Dimensions	Categories	Drivers
Institutional	Incentive alignment	Collaboration
	Decision synchronization	
	Information sharing	
	Satisfaction level towards collaboration	
Legal/contractual	Legal/contractual alignment	Entry barriers
	Organic food contracts related issues	
	Organic certification related issues	
	Costs of organic production	
	Localness issues related to Directive 2014/24/EU	
	Price and payment times public procurement	
	Price premiums on organic food	
	Contract duration	Contract characteristics
Spatial/logistic	Centralization level of procurement	Responsiveness
	Adequacy of logistic platforms	
	Urban–rural proximity	
	Product characteristics	Coordination
	Transaction characteristics	
	Transaction costs	

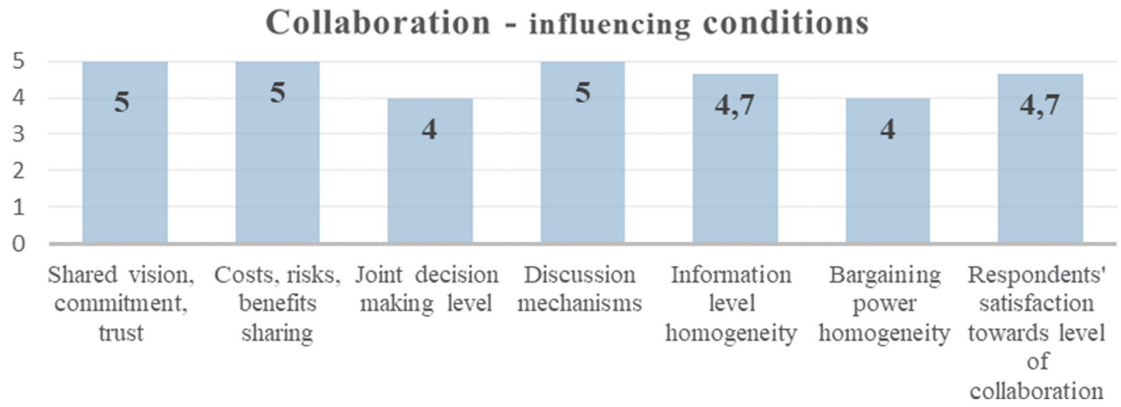

FIGURE 1
Institutional dimension influence on Collaboration. Higher scores, higher positive influence on collaboration.

associated categories highlighted the highly cooperative nature of the Biodistrict. This outcome was further supported by the high satisfaction towards the level of collaboration achieved expressed by respondents *(Q7)*. In this regard, the presence of short food supply chains was also reported to have encouraged an effective bottom-up governance, where all local parties (and not exclusively public authorities) can participate in decisions related to the Biodistrict management. Despite the high level of collaboration among local actors, the results show that the more significant economic and legal decisions remain a prerogative of regional and national institutions. A complete list of the qualitative and quantitative responses mentioned is available in Supplementary Table 2; Figure 1 reports a summary graphical representation of the influence of institutional aspects on the *Collaboration* driver.

4.2. Legal/contractual conditions

Price premiums on organic products *(Q14)* were found to be the most influencing contractual barriers to the integration between the Biodistrict and PSFP (see Supplementary Table 3; Figure 2). In particular, the contrast between the relatively high prices of organic food and the limited financial resources available to catering companies was reported to be the underlying issue of this challenge. This aspect was directly

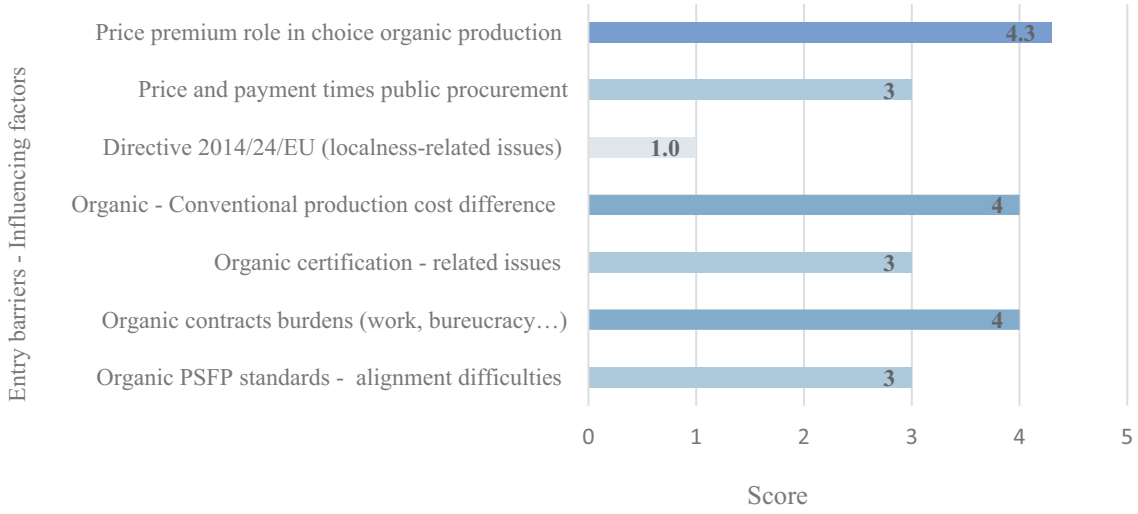

FIGURE 2
Legal/contractual dimension influence on entry barriers. Higher scores, higher barriers to entry.

linked to the school authorities' negative attitude towards signing contracts for organic food, not exclusively due to price, but also to volume-related issues *(Q9)*. From the producers' side, the financial and administrative burdens associated to the organic certification *(Q10)* were reported to have a moderate influence; in this regard, the bureaucracy involved was mentioned as the main barrier to enter a PSFP contract. On the other hand, the costs associated to organic production, although higher than those incurred by conventional producers *(Q11)*, were reported to be perfectly counterbalanced by the EU contribution to organic agriculture (see Supplementary Table 2). Answers to *Q13* confirmed that margins are lower and payment times are longer when farmers are involved in public procurement activities. Nevertheless, it was reported that the producers' willingness to participate to Public Procurement depends on the size of the transaction; in particular, they are usually willing to engage in this type of activity if the investment can potentially enable them to achieve economies of scale. The influence of the different EU standards and specifications *(Q8)* on the farmers' access to PSFP was reported to be moderate, thanks to public authorities' support to the inclusion of both certified and non-certified local organic producers *(Q12)*. This aspect, in turn, is favored by the direct relationships established in the SFSC, which result in high levels of inter-actor trust. Thanks to the Biodistrict's ability to overcome some of the typical obstacles to the implementation of organic PSFP, the consistent negative impact of legal/contractual barriers were partially offset. A complete list of the qualitative and quantitative responses mentioned in the paragraph is available in Supplementary Table 3; Figure 2 reports a summary graphical representation of the influence of legal/contractual aspects on the *entry barriers* driver.

4.3. Spatial/logistic management

Given the involvement of local actors (Municipality, School Canteen Commission, catering companies, local producers), procurement was defined as decentralized *(Q16)* (see Supplementary Table 4; Figure 3; Table 5). In particular, the direct relationship with local producers is overseen by catering companies. Furthermore, it was reported that logistic platforms do not exist (*Q18*) since the inter-actor proximity, favored by the prevailing short food supply chains, does not make it necessary, at least so far. Proximity was also considered a fundamental factor to access urban centers/schools (*Q19*); in fact, it was deemed as essential to increase the consumption of local food, given the buyers' higher trust towards local produce. Furthermore, proximity was recognized as a way of mitigating the logistic complexity related to dealing with multiple suppliers typical of School Food Procurement. Overall, the benefits of proximity were linked to the structure of the SFSC, all of which showed a high level of supply chain *responsiveness*. On the other hand, some of the questions influencing the uncertainty in the transactions, presented in the *coordination* driver, (*questions 20 to 26*) and summarized in Table 5, highlighted the difficulties encountered by school authorities in relation to the procurement of food from local organic producers. The main obstacle was represented by productivity issues (*Q20*), which led to a high volatility in the quantity supplied *(Q21)* and an insufficient range *(Q22)* of organic food from the Biodistrict (*Q22*). These proved to significantly impact transaction characteristics, which also reflected in the score homogeneity observed in questions 20–26. In fact, price volatility and insufficient products range were defined as the main causes of an increase in complexity, uncertainty and prices for buyers (*Q23*). In addition, the relatively small products range and the supply volatility were found, not surprisingly, to negatively influence schools' demand satisfaction *(Q24)* as well as the flexibility of the supply chain (*Q25* and *Q26*). The lack of flexibility was linked to the farmers' fear of investing to increase organic production, due to the higher risks related to the volatility of the organic products price and quantity supplied. Producers turned out not to be capable of easily adapting to changes in demand, as well as to exogenous factors (e.g., weather-related disasters). According to the experts interviewed, this led to the impossibility of solely relying on the organic supply from the Biodistrict, and the need to still resort to conventional producers. On the other hand, the transaction characteristics related to timeliness (*Q27* and *Q28*) were considered not to be dependent on product characteristics. In this regard, punctuality was reported to be guaranteed by the high level of responsiveness which, as mentioned above, depends on the proximity

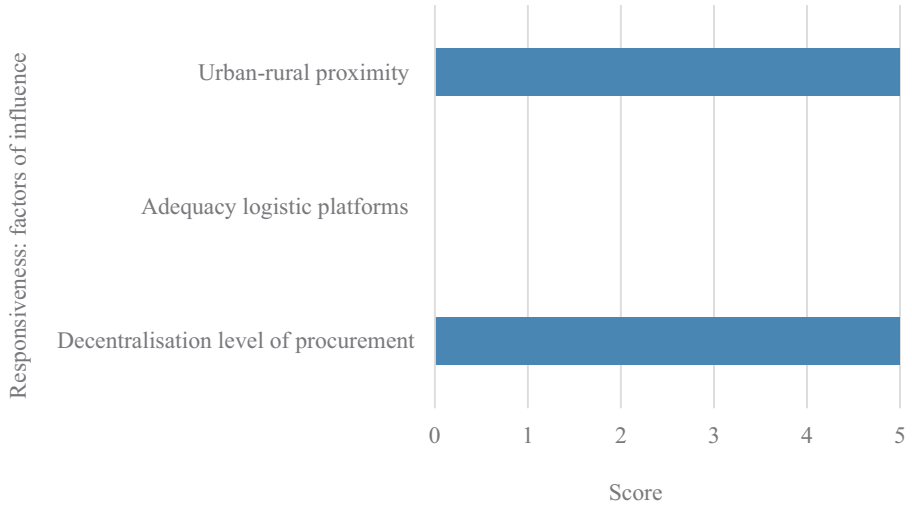

FIGURE 3
Spatial conditions influence on Responsiveness. Higher scores, higher positive influence on responsiveness.

TABLE 5 Relationship between product and transaction characteristics affecting Coordination.

	Transaction characteristics				
	Uncertainty for buyer				
	Quantity	Timeliness	Price	Complexity	Lack of flexibility
Product characteristics					
Variability/Availability	✓	–	✓	✓	✓
Product range		–		✓	✓
Drivers (Productivity issues)					
No pesticides allowed	–	–	–	–	–
Rotation	✓	–	✓	✓	✓

allowed by short food supply chains. In particular, despite the difficulties related to the product and transaction characteristics, direct relationships and the resulting lack of information asymmetry have proved to overcome part of the transaction costs (e.g., monitoring, screening costs…) and favor a quick and transparent flow of information and products. Proximity and direct relationships positively reflected on the timeliness of the delivery, and on the aggregated level of coordination, which was ultimately found to be moderately positive, in spite of the lack of flexibility in the farmers' supply. A complete list of the qualitative and quantitative responses mentioned in the paragraph is available in Supplementary Table 3. Figure 3 reports a summary graphical representation of the influence of spatial aspects on the *responsiveness* driver, while Figure 4 depicts the influence of product and transaction characteristics as well as transaction costs on *coordination*. Table 5 builds upon Figure 4 to illustrate the influence of product characteristics on transaction characteristics.

4.4. Results discussion

According to the results, the *institutional dimension* was most influential in positively affecting the relation between the Biodistrict's farmers and the other organizations supporting organic school meals. In particular, the *incentive alignment* (*Q1*, *Q2*) and *information sharing* (*Q5*, *Q6*) categories obtained very high scores. The former category was reported to be characterized by a strong shared vision, commitment, and trust. In fact, the positive social interactions between the Biodistrict's members proved to increase the engagement among the supply chain actors and were found to contribute to the definition of shared values. Overall, the categories related to the institutional dimension showed that a high level of collaboration is one of the distinctive traits of the Biodistrict (Figure 1). On the other hand, the *legal/contractual dimension* showed more heterogeneous results, where both strengths and weaknesses of the Biodistrict in relation to organic PSFP emerged. In this regard, the price premiums on organic products *(Q14)* and the bureaucratic burdens related to the signing of organic food contracts *(Q9)* were reported to be the most influencing barriers to entry organic school meals programs. In contrast, the impact of Directive 2014/24/EU on local/small producers' accessibility to markets *(Q12),* was the least influencing condition (Figure 2). The *responsiveness* driver related to the *spatial/logistic dimension* was characterized by highly positive and homogeneous results, since *Q16* (procurement level of decentralization) and *Q19* (impact of proximity on access to urban centers/schools) obtained top scores (Figure 3). On the other hand, the categories related

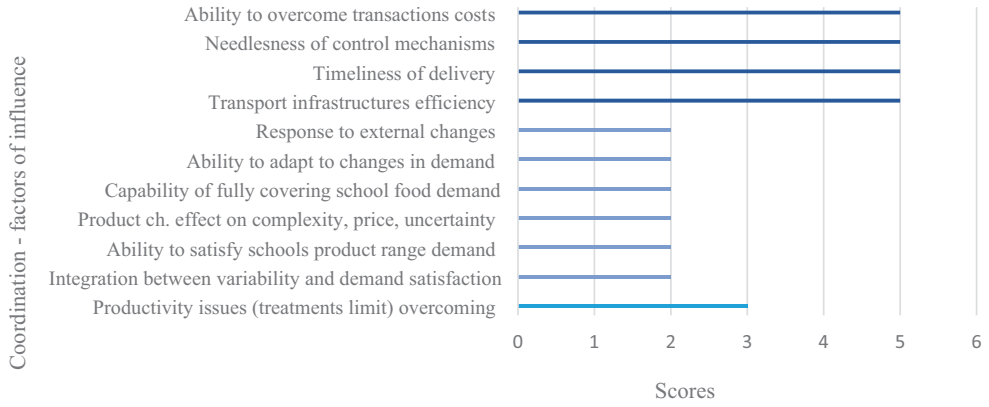

FIGURE 4
Influence of product characteristics, transaction characteristics and transaction costs on coordination. Higher scores, higher positive influence on coordination.

to the *coordination driver* showed homogeneous low scores in questions from 20 to 26; the product (*Q20–23*) as well as the transaction characteristics (*Q24–26*) were found to negatively impact *coordination* (Table 5). On the contrary, positive scores were observed in *Q27* and *Q28*, where the transaction characteristics linked to timeliness were considered. The high score in timeliness is coherent with the high level of *responsiveness*, since the broad concept of responsiveness strictly refers to supply chain timeliness favored by spatial factors. *Q29* and *Q30* also received the maximum score, showing a positive influence of the absence of information asymmetry on coordination. Similarly, the lack of information asymmetry proved to directly relate to the high level of information sharing *(Q2)* and the overall high level of collaboration.

5. Conclusion

The study's added value mainly consisted of the development of a flexible framework aimed at supporting the improvement of supply chain relationships between biodistricts and PSFP. The study, focused on the Cilento Biodistrict, provided the following relevant insights, summarized in Table 6. First, an outstanding level of transparency among actors was observed, when compared to traditional supply chains. In particular, the social proximity typical of the SFSCs established in the Biodistrict was reported to be the most positively influential feature. As a result, the specific context in which SFSCs operate seemed to reduce the negative influence of information asymmetry on supply chain performances. This aspect highly differs from the literature findings, where information asymmetry is defined as one of the most frequent and important barriers in the efficient management of supply chains (Hobbs and Young, 2000; Minarelli et al., 2016a; Louro et al., 2017). Transparency-based relationships also proved to encourage the inclusion of local actors in public procurement. In fact, although not all the producers in the Biodistrict are certified, local authorities have managed to favor both certified and non-certified farmers' access to the local market by means of different inclusion mechanisms. These results confirmed the highly collaborative nature of biodistricts highlighted by Basile et al. (2021), Sturla et al. (2019) and Pugliese et al. (2016). On the other hand, despite some studies report the biodistricts' willingness to implement group organic certification (Pugliese et al., 2016), none of the respondents knew of their existence in the Cilento Biodistrict; this shed light on the difficulties in extensively implementing the OC in contexts where small family farms are prevailing (Sturla et al., 2019; Basile et al., 2021). Considering the Biodistrict valorization of non-certified local organic producers by means of collaboration and inclusion mechanisms, the adoption of Participatory Guarantee Systems could represent an option worth exploring.[12] From a logistics point of view, the SFSC proved to positively influence efficiency and timeliness in the exchange of products and information; the resulting proximity between the chain actors also reduced the need for logistics platforms. Overall, the stakeholders' motivation towards increasing the adoption of organic food seemed to be one of the most encouraging factors supporting the integration between farmers and schools in the Biodistrict. As an example, the Municipality of Vallo della Lucania is working on a project to develop 100% organic school canteens. Their goal is to almost rely on local organic production entirely, suggesting that an improvement in the synchronization with producers is a very likely outcome. This goal is supported by the farmers' focus on increasing biodiversity in organic production, consequently broadening the range of organic products supplied by the Biodistrict. Major difficulties for school canteens, related to exclusively buying organic products, also emerged. The main issue was linked to the high prices of organic products, supporting previous findings (Izumi et al., 2010; Lehtinen, 2012; Krivašonoka, 2017; ICLEI and IFOAM, 2021). Other challenges related to the supply of organic products from the biodistrict's farms, especially in terms of products' volume and range (Sonnino, 2009; Risku-Norja and Løes, 2016; Krivašonoka, 2017) were also confirmed. As a result, PSFP was found to be still dependent on conventional producers, within and outside the Biodistrict.

Support for the exchange and/or a joint supply of products and services among biodistricts could partially overcome some of these problems. In this regard, the inclusion of organic ingredients from sustainable/fair trade farming outside of Italy and Europe should also be considered. Along with the creation of fruitful synergies with similar

12 PGSs are "locally focused quality assurance systems," which "[...] certify producers based on active participation of stakeholders and are built on a foundation of trust, social networks and knowledge exchange" (IFOAM, 2022).

TABLE 6 Advantages and challenges of local organic PSFP.

+	−
Outstanding inter-actor transparency levels supported by SFSCs	Local producers' skepticism due to PSFP lower margins
Inclusion of local producers fostered by transparency-based relationships	
Bottom-up governance in the Biodistrict favored by SFSCs	
Farmers' opportunity to enter the organic food market	Entry barriers related to legal requirements/certification costs/bureaucracy
Group certification prospects	Scarce understanding of group certification implementation
High level of product and information delivery timeliness thanks to proximity (SFSC)	Producers' difficulty in fast responding to demand and exogenous changes
Increased knowledge of producers results in higher trust towards organic produce and methods	Alignment issues between price premiums for organic products and catering companies' limited budgets
	Impossibility for local producers to fully satisfy demand (supply volatility and limited product range) leads to higher complexity and uncertainty for schools

realities, this would also allow the food preferences/habits of the increasing share of students from different cultural backgrounds to be addressed.

The study encountered a few limitations. Although the semi-structured interviews provided a value added to the analysis, they were perceived as more time consuming compared to answering an online structured questionnaire. As a result, the number of respondents was relatively low. Additionally, interviewing a representative of the catering companies involved in the Cilento Biodistrict, considered a relevant group of actors in the supply chain, was not possible.

The study should be extended to other biodistricts and better integrated by involving a broader number and range of representatives of other relevant categories of stakeholders. Further research aiming at developing a more efficient access of biodistricts to organic PSFP should address the role of contractual arrangements, the synchronization between local farmers' supply and buying authorities' demand, and its influence on the price, range and volumes of organic products. The contract duration, price definition, and alignment of school meals composition to the seasonality of the food supply, together with the new food demand emerging from the recent immigration should also be explored to this end. The possibility for biodistricts to adopt group certification and Participatory Guarantee Systems (PGS) in organic PSFP should also be considered in future research.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found in the article/Supplementary material.

Author contributions

BK developed the theoretical and analytical frameworks following CZ's guidelines on the overall methodology of the research. CZ provided contacts for the data collection part and literary sources of interest for the study. All authors contributed to conception and design of the study, the manuscript revision, read, approved the submitted version, and were jointly drafted the introduction, results discussion, and conclusion.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsufs.2023.1235871/full#supplementary-material

References

Assiri, M., Barone, V., Silvestri, F., and Tassinari, M. (2021). Planning sustainable development of local productive systems: a methodological approach for the analytical identification of ecoregions. *J. Clean. Prod.* 287:125006. doi: 10.1016/j.jclepro.2020.125006

Baldi, S. (2014). Centralization versus decentralization: the case of Italian pharmaceutical procurement. *L'Industria* 4, 593–620. doi: 10.1430/78939

Basile, S., (2020). The eco-regions: introductory phase: pathways to cooperation, Salerno, Biodistretto Cilento, 2020, pp. 11–15 Proceedings 6th ALGOA Summit on "Building Alliances Beyond Asia" & naugural GAOD Summit, Goesan County, South Korea

Basile, S., Buonomo, E., and Basile, R. (2021). *Report on organic districts (or eco-regions or biodistricts) in Europe – Comparative analysis on organic districts (or eco-regions or biodistricts) in Europe*. Italy: International Network of Eco-Regions.

Basile, S., and Cuoco, E. (2013), Territorial biodistricts to boost organic production. IDEASS. Available at: https://www.ideassonline.org/innovations/brochureView.php?id=91 Accessed September 15, 2022.

Boyano, L A., Espinosa Martinez, M. N., Rodriguez Quintero, R., Neto, B., Gama, M., and Wolf, O. (2019). *EU GPP criteria for food procurement, catering services and vending machines*. Publications Office of the European Union, Luxembourg

Bruckmayer, M., Picken, N., and Flemons, L. (2021). *Provision of school meals across the EU - an overview of rationales, evidence, facilitators and barriers*. Publications Office of the European Union, Luxembourg

Caputo, P., Clementi, M., Ducoli, C., Corsi, S., and Scudo, G. (2017). Food chain evaluator, a tool for analyzing the impacts and designing scenarios for the institutional catering in Lombardy (Italy). *J. Clean. Prod.* 140, 1014–1026. doi: 10.1016/j.jclepro.2016.06.084

Chrisidu-Budnik, A., and Przedańska, J. (2017). The agency theory approach to the public procurement system. *Wroc. Review Law, Adm. Econ* 7, 154–165. doi: 10.1515/wrlae-2015-0059

Del Borghi, A., Gallo, M., Strazza, C., and Del Borghi, M. (2014). An evaluation of environmental sustainability in the food industry through life cycle assessment: the case study of tomato products supply chain. *J. Clean. Prod.* 78, 121–130. doi: 10.1016/j.jclepro.2014.04.083

Djekic, I., Batlle-Bayer, L., Bala, A., Fullana-i-Palmer, P., and Jambrak, A. R. (2021). Role of the food supply chain stakeholders in achieving UN SDGs. *Sustainability* 13, 1–16. doi: 10.3390/su13169095

Djekic, I., and Tomasevic, I. (2020). "Role of sustainable quality in the food chain" in *Zero Hunger. Encyclopedia of the UN Sustainable Development Goals*. eds. W. Leal Filho, A. Azul, L. Brandli, P. Özuyar and T. Wall (Cham: Springer)

European Union (2002). General food law, ec.Europa.Eu. Available at https://food.ec.europa.eu/horizontal-topics/general-food-law_en Accessed September 1, 2022.

European Union (2014). Directive 2014/24/EU of the European Parliament and of the council of 26 February 2014 on public procurement and repealing directive 2004/18/EC. Eur-lex.Europa.EU. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0024 Accessed September 1, 2022.

European Union (2016). Consolidated version of the treaty on European Union, eur-lex.Europa.Eu. Available at: https://eur-lex.europa.eu/collection/eu-law/treaties/treaties-force.html#new-2-51 Accessed September 4, 2022.

European Union (2018a), Regulation (EU) 2018/848 of the European parliament and of the council. Ec.Europa.EU. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32018R0848 Accessed September 1, 2022.

European Union (2018b). *Sustainable public procurement of food*, available at: https://www.researchgate.net/publication/325415058_Sustainable_public_procurement_of_food

European Union (2021). Organic action plan. Available at: https://agriculture.ec.europa.eu/farming/organic-farming/organic-action-plan_en Accessed September 10, 2022

European Union (2023). Green Public Procurement, ec.europa.eu. Available at: https://ec.europa.eu/environment/gpp/index_en.htm Accessed August 29, 2022

Fawcett, S. E., Magnan, G. M., and McCarter, M. W. (2008). Benefits, barriers, and bridges to effective supply chain management. *Int. J. Supply Chain Manag.* 13, 35–48. doi: 10.1108/13598540810850300

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

Galli, F., Brunori, G., Di Iacovo, F., and Innocenti, S. (2014). Co-producing sustainability: involving parents and civil Society in the Governance of school meal services. A case study from Pisa Italy. *Sustainability* 6, 1643–1666. doi: 10.3390/su6041643

Gebresenbet, G., and Bosona, T. (2012). "Logistics and supply chains in agriculture and food" in *Pathways to supply chain excellence*. eds. A. Groznik and Y. Xiong (Croatia: Intechopen), 125–146.

Ghedira, M., Busacca, E., Cuoco, E., Petrelli, L., Bteich, M. R., and Pugliese, P. (2020). *La certificazione di gruppo in agricoltura biologica: le nuove regole europee a confronto*. Bari: CIHEAM

Harris, P. J. C. (2008), Certification and trade issues in organic agriculture, Proceedings of the 1st West African Summit and 4th National Conference of the Organic Agriculture, November 2008. Available at: https://www.researchgate.net/publication/251236207_Certification_and_Trade_Issues_in_Organic_Agriculture

Hobbs, J. E. (2004). Information asymmetry and the role of traceability systems. *Agribusiness* 20, 397–415. doi: 10.1002/agr.20020

Hobbs, J. E., and Young, L. M. (2000). Closer vertical co-ordination in Agri-food supply chains: a conceptual framework and some preliminary evidence. *Int. J. Supply Chain Manag* 5, 131–143. doi: 10.1108/13598540010338884

ICLEI (2022a) Manifesto for establishing minimum standards for public canteens across the EU. iclei-europe.org. Available at: https://iclei-europe.org/publications-tools/?c=search&uid=AXvXw6K2 Accessed October 15, 2022.

ICLEI (2022b) *Report on innovative criteria and models for procurement of sustainable and healthy school meals*. Available at: https://www.oneplanetnetwork.org/knowledge-centre/resources/report-innovative-criteria-and-models-procurement-sustainable-and

ICLEI and IFOAM (2021). Sustainable public procurement of food: a goal within reach. iclei-europe.org. Available at:https://iclei-europe.org/news/?Sustainable_Public_Procurement_of_Food__a_Goal_Within_Reach_&newsID=Y3kGqgda Accessed October 25, 2022.

IFOAM (2022). Participatory guarantee systems. Ifoam.Bio. Available at: https://www.ifoam.bio/our-work/how/standards-certification/participatory-guarantee-systems Accessed November 5, 2022).

Izumi, B. T., Wright, D. W., and Hamm, M. W. (2010). Farm to school programs: exploring the role of regionally-based food distributors in alternative agrifood networks. *Agric. Hum. Values* 27, 335–350. doi: 10.1007/s10460-009-9221-x

Jouzi, Z., Hossein, A., Taheri, F., Zarafshani, K., Gebrehiwot, K., Van Passel, S., et al. (2017). Organic farming and small-scale farmers: Main opportunities and challenges. *Ecol. Econ.* 132, 144–154. doi: 10.1016/j.ecolecon.2016.10.016

Kretschmer, A., Spinler, S., and Van Wassenhove, L. N. (2013). A school feeding supply chain framework: critical factors for sustainable program design. *Prod. Oper. Manag.* 23, 990–1001. doi: 10.1111/poms.12109

Krivašonoka, I. (2017), *Regulations of public food procurement: opportunities and challenges, proceedings of the research for rural development*. Available at: https://www.researchgate.net/publication/323659752_Regulations_of_public_food_procurement_opportunities_and_challenges

Lehtinen, U. (2012). Sustainability and local food procurement: a case study of Finnish public catering. *Br. Food J.* 114, 1053–1071. doi: 10.1108/00070701211252048

Leitner, C., and Vogl, C. R. (2020). Farmers' perceptions of the organic control and certification process in Tyrol, Austria. *Sustainability* 12, 1–21z. doi: 10.3390/su12219160

Louro, C. S., Storcksdieck Genannt Bonsmann, S., Bakogianni, I., Gauci, C., Calleja, A., and Furtado, A. (2017) *Public procurement of food for health: technical report on the school setting*, Publications Office of the European Union, Luxembourg.

Maiellaro, J. R., Reis, J. G. M. D., Muçouçah, F. J., and Santos, D. N. D. (2019). Developing a system to improve food distribution in public schools: a case in Mogi das Cruzes. *Agrarian* 12, 111–120. doi: 10.30612/agrarian.v12i43.9207

Maietta, O. W., and Gorgitano, M. T. (2016). School meals and pupil satisfaction. Evidence from Italian primary schools. *Food Policy* 62, 41–55. doi: 10.1016/j.foodpol.2016.04.006

Meijer, L. L. J., Huijben, J. C. C. M., Van Boxstael, A., and Romme, A. G. L. (2019). Barriers and drivers for technology commercialization by SMEs in the Dutch sustainable energy sector. *Renew. Sust. Energ. Rev.* 112, 114–126. doi: 10.1016/J.RSER.2019.05.050

Mikkelsen, B., and Sylvest, J. (2012). Organic foods on the public plate: technical challenge or organizational change? *J. Foodserv. Bus. Res.* 15, 64–83. doi: 10.1080/15378020.2011.650541

Minarelli, F., Galioto, F., Raggi, M., and Viaggi, D. (2016a) Modelling asymmetric information in a food supply chain within Emilia Romagna region, 149th seminar European Association of Agricultural Economists. Rennes, France.

Minarelli, F., Galioto, F., Raggi, M., and Viaggi, D. (2016b) Asymmetric information along the food supply chain: a review of the literature. Available at: https://www.semanticscholar.org/paper/Asymmetric-information-along-the-food-supply-chain%3A-Minarelli-Galioto/106a4deb82f9d78d0c3a24588cd7bc49171352b7

Mohseni, S., Baghizadeh, K., and Pahl, J. (2022). Evaluating barriers and drivers to sustainable food supply chains. *Math. Probl. Eng.* 2022, 1–24. doi: 10.1155/2022/4486132

Morgan, K., and Sonnino, R. (2006). Empowering consumers: the creative procurement of school meals in Italy and the UK. *Int. J. Consum. Stud.* 31, 19–25. doi: 10.1111/j.1470-6431.2006.00552.x

Oberholtzer, L., Dimitri, C., and Greene, C. (2005), *Price premiums hold on as U.S. organic produce market expands*, United States Department of Agriculture.

Pawlewicz, A. (2020). Change of Price premiums trend for organic food products: the example of the polish egg market. *Agriculture* 10, 1–22. doi: 10.3390/agriculture10020035

Pietrzak, M., Chlebicka, A., Kraciński, P., and Malak-Rawlikowska, A. (2020). Information asymmetry as a barrier in upgrading the position of local producers in the global value chain—evidence from the apple sector in Poland. *Sustainability* 12, 1–21. doi: 10.3390/su12197857

Pugliese, P., Antonelli, A., Basile, S., Zanasi, C., and Rota, C. (2016). *L'agricoltura biologica in chiave territoriale - L'esperienza dei bio-distretti in Italia*. Bari: CIHEAM

Risku-Norja, H., and Løes, A. K. (2016). Organic food in food policy and in public catering: lessons learned from Finland. *Org. Agric.* 7, 111–124. doi: 10.1007/s13165-016-0148-4

Simatupang, T., and Sridharan, R. (2005). The collaboration index: a measure for supply chain collaboration. *Int. J. Phys. Distrib. Logist. Manag.* 35, 44–62. doi: 10.1108/09600030510577421

Sonnino, R. (2009). Quality food, public procurement, and sustainable development: the school meal revolution in Rome. *Environ. Plann. A Economy Space* 41, 425–440. doi: 10.1068/a40112

Sturla, A., Viganò, L., Longhitano, D., Bimbati, B., Dara, Guccione G., et al (2019). L'agricoltura biologica per lo sviluppo territoriale - L'esperienza dei distretti biologici. Rete Rurale Nazionale 2014/2020.

Teniwut, W. A., Betaubun, K. D., Marimin, M., and Djatna, T. (2018). Asymmetric information mitigation in supply chain: a systematic literature review. *J. Supply Chain Manag.* 7, 183–194. doi: 10.59160/ijscm.v7i5.2038

Veldstra, M. D., Alexander, C. E., and Marshall, M. I. (2014). To certify or not to certify? Separating the organic production and certification decisions. *Food Policy* 49, 429–436. doi: 10.1016/j.foodpol.2014.05.010

Wahlen, S., Heiskanen, E., and Aalto, K. (2012). Endorsing sustainable food consumption: prospects from public catering. *J. Consum. Policy* 35, 7–21. doi: 10.1007/s10603-011-9183-4

Yu, Y., and He, Y. (2021). Information disclosure decisions in an organic food supply chain under competition. *J. Clean. Prod.* 292:125976. doi: 10.1016/j.jclepro.2021.125976

Zanasi, C., Basile, S., Rota, C., and Pugliese, P. (2020). Design of a Monitoring Tool for eco-regions. *Front. sustain. food syst.* 4:536392. doi: 10.3389/fsufs.2020.536392