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Supply chain collaboration for sustainability: a qualitative investigation of food supply chains in Brazil

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Abstract

Purpose – This paper investigates how chain members collaborate to ensure the sustainability of supply chains through the social capital perspective.

Design/methodology/approach – Following a case study design, three social capital mechanisms – reach, richness and receptivity – were used as a lens with two eco-innovative food companies and their respective supply chains in Southern Brazil. Data consisted of interviews and other sources of evidence obtained from multiple stakeholders.

Findings – Results highlight the importance of a managerial orientation for sustainability and that sustainable chains presuppose a network that is closely linked and with great affinity. Not only does the management of operations improve the green performance of companies for environmental benchmarking but it also expands to include the supply chain. Social capital mechanisms can encourage partners to develop strategic initiatives for sustainability, especially if managers share key drivers for adopting eco-innovations and overall chain sustainability.

Originality/value – The paper contributes to research on collaboration within sustainable supply chain management. Empirical data were gathered from different stakeholders in two food chains in a developing country. Through the lens of social capital mechanisms, the paper shows how different types of companies collaborate in their supply chain for sustainability.

Keywords Sustainable supply chain management, Collaboration, Social capital, Eco-innovation, Agri-food sector

Paper type Research paper

1. Introduction

For some time, sustainability has been a central issue in organizations (Elzen and Wieczorek, 2005), and it is "unlikely that this shift in thought and philosophy will return to the classical economic perspective of the firm as a single-minded profit-seeking entity" (Sarkis, 2001,

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p. 666). Companies usually need the support of supply chains when developing sustainable practices and products (Dangelico and Pujari, 2010; Seuring and Müller, 2008) in such a way that a supply chain perspective is useful to understand the pursuit of this sustainability (Johnson *et al.*, 2018). According to this perspective, a sustainable supply chain performs well in economic, environmental and social terms (Pagell and Wu, 2009).

Sustainable supply chain management (SSCM) refers to the management of resources within a company and the collaboration of members throughout the supply chain, taking into account the three dimensions of sustainable development that are required from customers and other stakeholders (Seuring and Müller, 2008). For a supply chain to be sustainable, therefore, its members need to implement sustainability and supply chain management practices (Beske, 2012), so that sustainability permeates the companies and the supply chain (Pagell and Wu, 2009; Sarkis, 2001).

The adoption of green practices at the chain level involves risks (Mangla *et al.*, 2015). A study of Indian polyplastic manufacturing companies found the operational risk category to be the most important risk category when implementing green supply chain practices (Mangla *et al.*, 2015). Managers – especially those in emerging economies – may not know how to handle these risks because they lack an understanding of how to adopt more sustainable practices from an operational perspective (Mangla, 2020).

Decision categories in an operational strategy are related to internal categories and external factors. Collaboration among stakeholders is an internal category and influences supply chain configuration. Collaborative relationships and innovations are essential for a sustainable supply chain (SSC) (Govindan *et al.*, 2016) and are also an area that requires more studies (Chen *et al.*, 2017). A company must implement its operational strategy by choosing suppliers and distributors that are aligned with its strategic orientation. Viewed in this light, chain members can support (or limit) the management of SSCs. Therefore, this paper proposes the following research question: *how do chain members collaborate to ensure the sustainability of supply chains through the social capital perspective?*

This research question is investigated through the lens of social capital theory, which states that developing a network of partners that share similar norms, values and understandings facilitates cooperation within and/or between groups (OECD, 2001). Scholars studied different aspects of social networks (Gulati *et al.*, 2011): their structure (Burt, 1992; Coleman, 1988), the characteristics of interorganizational relations (Granovetter, 1985, 1992) and how these relations can provide resources to the organizations (Gulati *et al.*, 2000; Lavie, 2006). Gulati *et al.* (2011) combined these aspects into three social capital mechanisms (reach, richness and receptivity), which we have used in this paper as the theoretical lens.

This paper contributes by providing empirical data relating social capital perspective to sustainability in supply chains (Johnson *et al.*, 2018). Furthermore, to the best of the authors' knowledge, no empirical study has investigated the three mechanisms proposed by Gulati *et al.* (2011). Johnson *et al.* (2018) used the framework to conceptually explain how social capital can create strategic value for nongovernmental organizations (NGOs) that seek to improve the environmental performance of companies by way of collaboration. Kavusan and Frankort (2019) used the receptivity and richness mechanisms in developing and testing a behavioral theory of alliance portfolio reconfiguration. Alinaghian and Razmdoost (2018) used the rarity mechanism to explore how network resource attributes may affect network-oriented dynamic capability clusters. Therefore, there is an opportunity for developing and testing theory using this framework, both for dyads and at the supply chain level (Johnson *et al.*, 2018).

The focus of the study is food supply chains since research lacks studies on sustainability in food supply chains (Farooque *et al.*, 2019). The path of a food product from producer to the consumer's table is long, numerous agents are involved and many value chain activities have to be performed along the way. Therefore, sustainability is both a challenge and a solution

since it is a complex issue that entails supply chain integration and collaboration for tackling environmental impacts.

The agricultural and food sectors have an important impact on planetary systems and present relevant challenges when it comes to meeting the UN's sustainable development goals (Aschemann-Witzel and Peschel, 2019). The food sector accounts for a large amount of the world's total energy consumption and greenhouse gas emissions (United Nations, 2019). Around one-third of the food produced in the world is lost or wasted along the food supply chain (FAO, 2013). Extensive food production contributes to the increase in greenhouse gas emissions, soil degradation, biodiversity impacts and excessive water consumption (Jurgilevich *et al.*, 2016). With the need to feed a world population estimated to reach as many as 10.2 bn people by 2050, food production will need to increase by at least 70% (United Nations, 2017). Therefore, growth in the sector should be based on more sustainable practices.

Since research lacks empirical data on SSCM in emerging economies (Gandhi *et al.*, 2016; Mangla, 2020; Rajeev *et al.*, 2017), data were collected from food supply chains in Brazil. Brazil is one of the main food producers in the world and an important commodity supplier to the global market and this requires an increase in its sustainable production. The agri-food sector is of great economic and social relevance in Brazil, representing a significant proportion of the country's gross domestic product (Associação Brasileira das Indústrias de Alimentação, 2017) and employing 9% of the Brazilian workforce in 2015 (United Nations Conference on Trade and Development, 2017). Despite the expressiveness of the sector, Brazil is considered a commodity-dependent country, which tends to be negatively related to poverty alleviation and food security (United Nations Conference on Trade and Development, 2017). There are also high levels of food wastage, with Brazil being among the ten most food-wasteful countries in the world (Cruz, 2016). Brazilian food companies can take positive action by investing in more sustainable practices and products.

Therefore, the paper empirically investigates collaboration for sustainability in multitier food supply chains in Brazil. By investigating two cases in the agri-food sector, we aim to understand different types of collaboration between stakeholders, according to different supply chain models. Besides this introductory section, the following sections present the theoretical background of the work, its methodological procedures, results, discussion and conclusions.

2. Literature review

This section reviews the literature on sustainability in supply chains, collaboration in SSCM and social capital.

2.1 Sustainability and eco-innovations in supply chains

To become more sustainable, different practices can be implemented in the food sector. Some of these practices may also be innovative and combine sustainability and innovation. As innovations are a precursor to an SSC (Pagell and Wu, 2009), this paper focuses on eco-innovations – i.e. innovations with reduced negative impacts on the environment (Demirel *et al.*, 2019).

Eco-innovations are product, process, marketing and organizational innovations that contribute to sustainable development (Horbach *et al.*, 2012; De Vargas Mores *et al.*, 2018), irrespective of whether these effects are explicit goals or the side effects of eco-innovative practice. Eco-innovations can produce positive results in terms of environmental attributes and critical success factors, such as style, design and performance (Bossle *et al.*, 2016b; Carrillo-Hermosilla *et al.*, 2010). They can be of benefit to a company by anticipating stringent

environmental regulation, thus generating a competitive advantage and improving image and acceptability (Eiadat *et al.*, 2008).

Considering that the intended outcomes of an SSC are a high performance in terms of its economic, environmental and social indicators (Pagell and Wu, 2009), and that eco-innovations generate environmental benefits, this paper argues that eco-innovations are aligned with the intended outcomes of an SSC and so, it adopts the eco-innovation concept to represent sustainable practices. Table 1 presents some examples of eco-innovations in the agri-food sector.

Examples of eco-innovations in the agri-food sector	Source
Eco-innovative foods are those endowed with ethical/social/environmental appeal, such as organic food, meat or eggs from free-range animals, fair trade, family agriculture, among others	De Barcellos *et al.* (2015), Bossle *et al.* (2015)
Antibiotic-free poultry, traceability, food that is organic, biodynamic or natural	Bossle *et al.* (2015)
Basic ingredients (organic, free-range, etc.), packaging (recyclable), manufacturing processes (energy and water saving), logistics or distribution (new channels or direct consumer sales), certifications (traceability, eco-labels, ISO 14001, etc.) and commercial aspects (low-carbon footprint)	Bossle *et al.* (2016a)
Examples of eco-innovation at different chain levels are[a] (1) Chain level: closing the *P* nutrient loop, reduction in resource input, prevention of food losses, avoiding using landfill sites, food wastage through circular economy practices (e.g. industrial symbiosis for agriculture and food manufacturing waste) (2) Crops: reducing pesticide use (3) Manufacturing of food and drink: improving energy efficiency and reducing electricity use, implementation of water-saving measures (4) Packaging: reducing the amount of packaging per unit of product	Castellani *et al.* (2017)
Examples of eco-innovation in the wine industry: (1) Cleaner processes: use of raw materials produced using cleaner process methods, improvements in resource efficiency (increase in the productivity of raw materials and waste reduction) and reduction in water and energy consumption (2) End-of-pipe technologies: waste management and gas emission reductions (3) Use of organic raw materials, such as grapes	Muscio *et al.* (2017)
Eco-labels as an eco-innovation tool that contributes to the sustainable design, production and consumption of products	Prieto-Sandoval *et al.* (2016)
Examples of eco-innovations in terms of products and processes and on the novelty degree (incremental and radical): (1) Products: organic products and food products with high nutritional content (2) Processes: reduction in water pollution, waste management, solid waste collection, material recycling or incineration and energy recovery in food industries (3) Incremental: synthesizing products that require fewer resources (such as water and energy) and create less waste (4) Radical: novel protein foods replacing animal meat products, food additives based on nanomaterials and genetic engineering that diminishes the use of natural resources and reduces environmental damage	Triguero *et al.* (2018)

Note(s): [a]as the list of eco-innovations is quite extensive, the examples most related to the current study are presented. The complete list of eco-innovations reviewed by Castellani *et al.* (2017) is presented in the Supplementary Material 6 (SM6) of their paper

Table 1.
Examples of eco-innovations in the agri-food sector

When aiming for more sustainable agricultural practices, cooperation between different members of the food chain is vital (Smith, 2008). A recent study by Matzembacher *et al.* (2020) that investigated Brazilian companies indicates that collaboration is key to minimizing food waste. The study highlights the importance of strong relationships with different actors in the supply chain to promote food waste solutions.

Likewise, eco-innovations depend on external factors that require changes in raw materials or components and technological and technical integration with other partners in the chain (Buttol *et al.*, 2012; De Marchi, 2012). The adoption of eco-innovations involves cooperation with actors, such as suppliers, clients, competitors, consultants, universities, R&D, public laboratories and technology centers (Bossle *et al.*, 2016b). Reaching the right partners and the valuable resources in a network and leveraging them in the company becomes a key issue in the adoption of eco-innovation. Companies need to learn how to produce without burdening the environment; cooperation and interdependence between firms' customers, distributors and suppliers improve the likelihood of eco-innovating (Buttol *et al.*, 2012; De Marchi, 2012).

Successful eco-innovation is dependent on the participation of stakeholders. It tends to emerge from the cooperation between different stakeholders, as well as from partnerships between academia and the public and private sectors (Carrillo-Hermosilla *et al.*, 2010). Collaboration in the supply chain, therefore, is important for supporting the environmental performance of companies (Johnson *et al.*, 2018) and providing resources for innovation (Zimmermann *et al.*, 2016), which makes it worth investigating this matter further, as the next section does.

2.2 Collaboration for sustainable supply chain management

SSCM refers to the managerial decisions and behaviors adopted to create a sustainable chain (Pagell and Wu, 2009). Chains can achieve not only social and environmental benefits but also competitive advantages (Hall, 2000), that is, a superior performance (Corbett and Klassen, 2006) and the addition of value to both products and services (Pagell and Wu, 2009).

SSCM calls for multi-stakeholder initiatives and an improvement in collaboration between different actors in the supply chain (Van Hoof and Thiell, 2014; Pagell and Shevchenko, 2014; Pagell and Wu, 2009). According to a study of Indian manufacturing industries, collaborating with suppliers is an important success factor for implementing green practices in supply chain management (Gandhi *et al.*, 2016). A case study in Brazil with a cosmetics supply network found that active cooperation between the actors is a key element of successful green networks (De Oliveira *et al.*, 2019).

The lack of collaboration can also be a barrier to sustainability in the chain. Farooque *et al.* (2019) found that a lack of collaboration/support from supply chain actors is the most prominent barrier to circular food supply chains in China across different stakeholder groups. Effective supplier relationships and proper collaboration, therefore, are essential for successful SSCs, so much so that collaboration is considered to be an enabler and a prerogative of SSCM (Panigrahi *et al.*, 2019).

Having relationships with chain members that share norms, values and understandings – which are defined as social capital – can facilitate cooperation (OECD, 2001) and the achievement of more sustainable chains (Ashby *et al.*, 2012). Social capital, therefore, is a useful theory for advancing in SSCM and related fields (Ashby *et al.*, 2012; Liu *et al.*, 2018). The present research study applies this background theory to investigate collaboration between supply chain members for sustainability. The next section explains the theory in more detail.

2.3 Social capital

Social capital theory states that developing a network of partners that share similar norms, values and understandings facilitates cooperation within or between groups (OECD, 2001). Among the different social capital approaches employed are structural capital theories, the network theory of social capital and relational capital theories. Gulati, Lavie, and Madhavan (2011) integrated these approaches into three social capital mechanisms – reach, richness and receptivity – which individually and collectively shape organizational performance. Each mechanism represents a social capital approach and consists of key ideas (see Table 2). The value that a company derives from its interorganizational network should result from the interactions of these mechanisms (Gulati *et al.*, 2011).

Mechanism	Approach represented	Key ideas
Reach	Structural capital theories	(1) Distance: The distance between the organization and its partners in the network's structure; the extent of the organization's penetration in the network. Ties to distant actors provide greater reach than ties to proximate actors (2) Difference: How different the organization is from its partners in terms of organizational attributes, such as geographic location and cultural and institutional differences. The organization enjoys more straightforward access to resources furnished by organizationally similar partners (3) Diversity: The span of the network in terms of structural and organizational heterogeneity. Concerns variations in the organizational profiles and network positions of the organization's partners
Richness	The network theory of social capital and related theories	(1) Utility: The premium that users are willing to pay for services supported by network resources (2) Rarity: The relative unavailability of network resources to competitors. The *ex ante* and *ex post* limits on the capacity of competitors to access similar network resources (3) Appropriability: The extent to which network resources are accessible and transferable (4) Bilateral combinations: Integrating the resources of a single partner with the organization's resources (5) Multilateral combinations: An aggregation of multiple partners' resources that are accessible via simultaneous ties within the network
Receptivity	Relational capital theories	(1) Trust: The extent to which the organization and its partners can rely on each other to fulfill mutual obligations, behave predictably and negotiate and act in good faith (2) Commitment: The extent to which the organization's leadership recognizes the importance of relationships, cares about their long-term prospects, sponsors them and invests in their maintenance (3) Tie multiplexity: The extent to which ties to partners are based on relationships between multiple individuals and units in each partner's organization and involve multiple simultaneous agreements of various types

Source(s): Adapted from Gulati *et al.* (2011) and Johnson *et al.* (2018)

Table 2. Social capital mechanisms: definition, approaches represented and key ideas

Reach refers to the extent to which the organization's network of ties connects it to distant and diverse partners. It mostly refers to the structure of the relationships in the network, indicating how broad it is. A broad reach usually means more and more diverse connections but weaker ties (Johnson *et al.*, 2018). In the context of sustainability, reach can support value creation by connecting and organizing supply members that are usually disconnected by understanding how to be effective in a specific culture and by accessing cross-disciplinary knowledge and actions (Johnson *et al.*, 2018).

Richness represents the potential value inherent in the network resources available to the organization (Gulati *et al.*, 2011). Collaborating can provide companies with access to valuable resources for innovation (Zimmermann *et al.*, 2016) and for supporting the environmental performance of companies (Johnson *et al.*, 2018). However, partnering with companies that possess valuable resources is not enough: the relationship needs to facilitate exchanges, with trust, information and decision-making sharing, integration of information systems, compatibility of technologies, cooperative behavior and efficient management of supply chains (Zimmermann *et al.*, 2016). This is what the next mechanism implies.

Receptivity indicates the extent to which an organization can channel and leverage its accessible network resources across interorganizational boundaries (Gulati *et al.*, 2011). It refers to the quality of relations, and strong receptivity usually implies strong ties, which are fundamental in partnerships involving innovation but hard to create and maintain (Johnson *et al.*, 2018).

Thus, the current study applies these mechanisms to explore food supply chain sustainability in Brazil. As objects of the study, we analyzed two food companies and their supply chains, as detailed in the next section.

3. Methodological procedures

A case study approach was chosen to investigate how chain members collaborate to ensure the sustainability of supply chains. Since case studies using a single firm's supply chain are the dominant research methodology in SSCM (Ashby *et al.*, 2012), an effort was made here to investigate two supply chains. Thus, the study presents an embedded multiple-case design (Eisenhardt, 1989; Healy and Perry, 2000; Yin, 2003), with two focal companies embedded in their environments (other supply chain members and stakeholders) and focusing on interfirm relationships.

3.1 Cases' selection

In selecting the cases, four criteria were observed. The first criterion is the adoption of sustainable practices by the focal companies. The adoption of eco-innovations was used to select companies with sustainable practices. The second criterion is that the companies should belong to the agri-food sector. As explained in the introduction, these are sectors that have a high environmental impact and are expected to grow, so sustainable solutions are needed. The third criterion is location. Brazil was selected as the country of study. Therefore, the study's boundaries are limited to national actors. The fourth criterion was to choose companies with different business models, as is detailed further in this section. The distinctions between these polar cases were sought because it allows contrasting situations to be investigated (Eisenhardt, 1989).

To guarantee that cases were drawn from a broad list of companies, the selection was based on the database used by Bossle *et al.* (2016a) and Bossle (2015). This database originated from a survey with eco-innovative food companies in Brazil. The goal was to analyze how internal and external determining factors can influence the adoption of eco-innovation (Bossle *et al.*, 2016a).

After presenting the definition of eco-innovation [1], the questionnaire had a filter question so that only companies that applied or developed eco-innovation initiatives were selected. The questionnaire also had items relating to the internal and external motivating factors for adopting eco-innovations, performance, strategy and management and a description of the company (Bossle, 2015; Bossle *et al.*, 2016a).

Data for this survey were collected in 2015 by phone. A list of food companies in Brazil was obtained from the Federation of Industries of Rio Grande do Sul State and two organic certifying bodies and comprised 1,647 companies, of which 581 agreed to participate and from which 525 valid answers were obtained. The sample was randomly selected and respondents had to have knowledge of the decision-making and the new product development processes. They were chosen according to their position. Most companies were from the South, followed by the South-east and other regions in Brazil (Bossle, 2015; Bossle *et al.*, 2016a).

The current research study used this database to (1) select companies from Rio Grande do Sul State (for accessibility reasons) and (2) select the most eco-innovative companies according to the survey's filter question: "Considering the concept of eco-innovation, did your company introduce or implement one or some of the following innovations with environmental benefits?" This question presented 14 eco-innovations [2] according to the literature. To ensure theoretical sampling (Eisenhardt, 1989), this database was used to select food companies with 12 or more types of eco-innovation [3].

After filtering the region (Rio Grande do Sul) and the number of eco-innovations (12 or more), 20 companies were left. A pattern that emerged consisted of companies offering grape by-products and located in Vale dos Vinhedos ("The Valley of the Vineyards"), an Italian immigrant region in Rio Grande do Sul State. Of the 20 most eco-innovative companies in the survey, six were located there.

Although agri-food production in Brazil is mainly on a massive scale and export oriented, the use of grapes for juice, sparkling wine and table wine production has different features as companies are usually family-run and target the Brazilian market. The competitive advantage of these companies is that their products are developed locally and, therefore, readily recognized. Considering these facts and the pattern of eco-innovative companies emanating from the industry and the region, the focal companies were selected according to their location in Vale dos Vinhedos and for their grape juice production.

To meet the fourth selection criterion – different business models – the differences between these six companies were analyzed. First, the survey database was investigated. Differences were found in terms of the following factors: (1) revenue in 2013, by which the companies could be divided into three different categories; (2) year of establishment, which varied between 1820 and 2012; (3) the number of employees, which varied between eight and 200. The companies' websites were then checked and differences were perceived in four aspects. First, in terms of business proposal, four companies were characterized as wineries and two were not. Second, in terms of ownership, there were four family-run businesses and two cooperatives. Third, in terms of eco-innovative products, one company only offered organic and eco-innovative products; the other companies mostly offered nonorganic products but had a small portfolio of organic products. Fourth, in terms of sustainability orientation, one company was created with a sustainability orientation and the others were created with a more traditional orientation. Therefore, two companies that differed in these criteria were selected (Figure 1).

Finally, the two selected companies from the same region were contacted to confirm their willingness to participate in the study and to judge their responsiveness. Table 3 describes the focal companies and the main differences in their business proposals. *Company alpha* makes full use of grapes and has a brand name that stresses its production using a single ingredient – grapes. It sells its products mainly in Brazil. Its processes follow international

standards for organic production and the principles of hazard analysis and critical control point; the growers follow good agricultural practices, while the industry adopts good manufacturing practices.

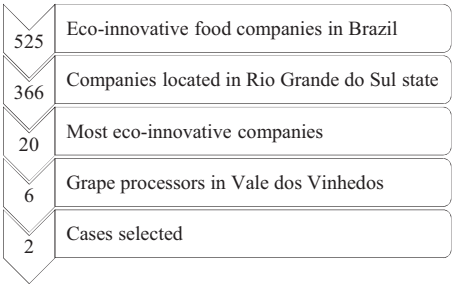


Figure 1.
Cases' selection

Focal company	Company alpha	Company beta
Foundation year	1996	1931
Ownership	Family business	Cooperative
Size	Small (nine employees + family members)	Large (170 employees + 380 cooperative members)
Products	Organic grape products: juice, vinegar, seed oil, seed and peel flours	12 product brands (one organic), with more than 70 items of juice, table and sparkling wines
Grape suppliers	30 organic farming families	380 farming families (33 organic)
Grape processed	500,000 organic kg/year	20 m (700,000 organic) kg/year
Main eco-innovations	(1) *Products:* pioneering eco-innovative products; all organic (2) *Packaging:* recycled and recyclable materials (glass bottles and cardboard); vacuum-packed juice (3) *Processes*: complete utilization of grape (zero waste); energy savings; biological wastewater treatment plant; organic food for employees; re-use of materials in processes and facilities; solar energy; eco-factory with natural lighting, natural ventilation, tank for rainwater, green roof; equipment adaptation; cold pressing process for the grapeseed oil (4) *Certifications*: organic (5) *Logistics and distribution*: location close to producers; transport rationalization; search for close suppliers; direct sales stores; shared transportation (6) *Marketing and services*: "*Ecopipa*" building, aimed at environmental tourism and events	(1) *Products:* organic line and biodynamic products under development; less preservative in nonorganic drinks (2) *Packaging:* glass bottles (some lines with lighter bottles) and cardboard boxes (3) *Processes:* ecological waste disposal; renewable sources of energy; fewer agrochemicals, water, and preservatives in crops; water treatment and reuse; technologies with environmental improvements (4) *Certifications:* organic; family farming label; biodynamic (in the process) (5) *Logistics and distribution:* neutralization of some carbon dioxide emitted in transport (6) *Marketing and services:* sustainability communication; eco-innovation to promote the company's image; the collection of customers' bottles

Table 3.
Description of the focal companies

Company beta is a cooperative and one of the five largest sparkling wine producers in Brazil. It pays associates according to the quality of the grapes they produce. It invests in European technology for making its table and sparkling wines. Grape juice is its main product, representing over 40% of the company's revenue. In 2014, one of its sparkling wines was included in the list of the 100 Best Wines of the World. The company sells in all states in Brazil. It also exports wine, but as there is high demand in the domestic market this only happens when it is specifically asked to do so.

3.2 Data collection and analysis

Data were collected from multiple sources (Eisenhardt, 1989; Yin, 2003): websites, folders, reports, videos, observation, field notes and interviews. Interviews followed a semi-structured interview script. The script had three main parts. The first part presented general questions on the company (history, main products and markets) and the interviewee (position and activities). In the second part, the eco-innovation concept was presented [4] and the questions concerned whether the interviewee considered there were eco-innovations in the company and to name them if there were and describe their history (the origin of the idea, the internal and external actors that collaborated for their development, etc.). In the third part, the interviewee was asked to describe the current state of eco-innovations (internal and external actors involved, challenges and opportunities and the relationship between the different chain members and eco-innovations). To ensure contingent validity, in-depth, open questions were asked (Healy and Perry, 2000).

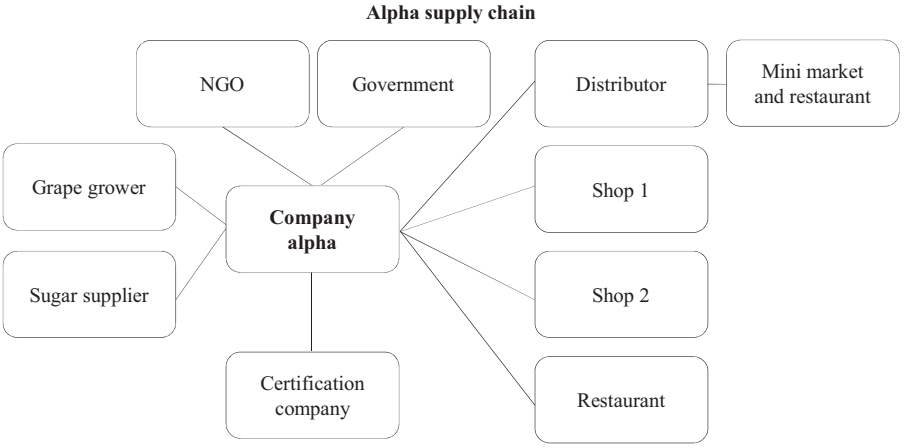
An interview protocol was followed to increase data collection reliability (Yin, 2003). On-site visits to the focal companies were conducted by multiple investigators, allowing the cases to be viewed from different perspectives (Eisenhardt, 1989). Emails were sent, or phone calls were made to check on details when it was considered necessary.

Interviews were conducted between June 2015 and January 2016 with 27 supply chain members (Figures 2 and 3). The focal companies indicated their supply chain members related to their eco-innovations. Interviews lasted between 20 min and two hours and were audio recorded and transcribed verbatim.

Data systematization started with the primary and secondary material, field notes and interviews' transcripts being uploaded into an NVivo file, which was used as the framework for the case study database (Healy and Perry, 2000). Data were coded according to the following macro-categories: stakeholder, supply chain, eco-innovations, SSCM and social capital mechanisms (reach, richness and receptivity). The social capital mechanisms were also categorized according to the key ideas in each mechanism (see Table 2). The coding of multiple data in NVivo allowed for the triangulation of information from different sources, facilitated data presentation and allowed information to be cross-referenced between the different levels.

Data were analyzed using a content analysis technique (Bardin, 2006), based on an analysis of the coded categories. The social capital mechanisms were analyzed individually initially and then the interaction between them was investigated. These categories were analyzed in (1) each chain separately (within-case analysis) and in (2) the chains as a whole (cross-case analysis). Within-case analyses helped us understand the patterns of cases, while cross-case analysis listed the similarities and differences between cases according to theoretical coding (Eisenhardt, 1989).

Trustworthiness was sought by way of a case study database, using quotations in the written report, providing matrices summarizing data and describing cases' selection and interview procedures (Healy and Perry, 2000). Results were based on different information sources, allowing converging lines of inquiry to emerge (Yin, 2003). Findings were categorized according to the social capital mechanisms, as presented in the next section.



Stakeholders	Interviewees
Grape grower	1. Grower
	2. Grower
Sugar supplier	1. National sales manager
NGO and government	1. Secretary of tourism and culture and NGO member
Company alpha (industry)	1. Entrepreneur
	2. Co-owner and nutritionist
	3. Co-owner and responsible for marketing and sales
Certification company	1. Quality manager
	2. Technical manager
Distributor	1. Partner and new projects director
Shop 1 (physical and online)	1. Manager
Shop 2 (natural products)	1. Owner and nutritionist
Restaurant	1. Sommelier and owner
Mini market and restaurant	1. Owner

Figure 2.
Stakeholders interviewed in chain alpha

4. Results: social capital mechanisms

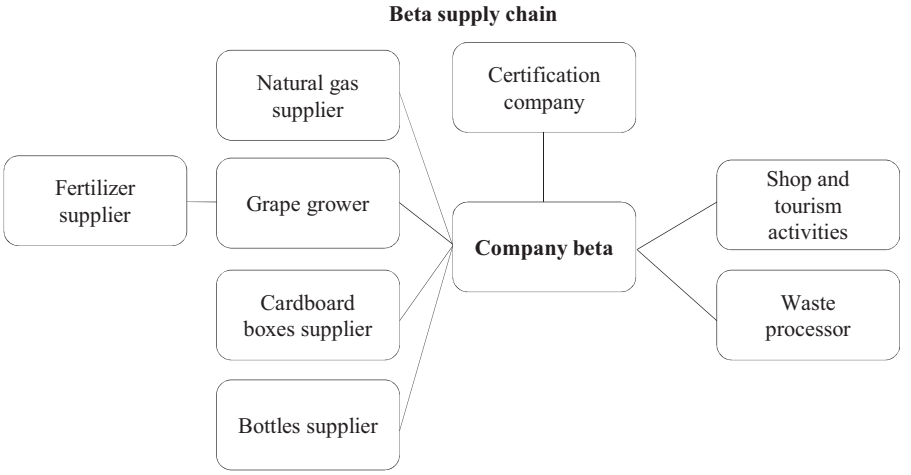
This section presents the results for the three social capital mechanisms: reach, richness and receptivity.

4.1 Reach

Figures 2 and 3 illustrate the reach of the chains in terms of those partners that support eco-innovation. Both chains have (and prioritize) a dense network, i.e. they develop ties to proximate actors. Distant partners complicate logistics, make personal contact less likely and increase transport costs. The choice of local partners is also related to sustainability goals and regional development. Therefore, the companies look for local suppliers – company alpha, for example, moved to a location that was central to its grape suppliers. When it comes to sales, the companies seek to expand their market in Brazil and, to a lesser extent, globally.

The greater the distance between chain members, the more commercial the relationship – e.g. the organic sugar from another state is supplied based on a commercial transaction, while the relationships with local grape growers are based on strong partnerships. Organizations that are located close by, therefore, seem to have a better chance of influencing and assisting in the quest for sustainability.

Besides the location, the similarities that favor eco-innovation are size and orientation. Companies of different sizes have unequal bargaining powers, and this affects sustainability negotiations. For example, the focal companies need a minimum amount of packaging to



Stakeholders	Interviewees
Fertilizer supplier	1. Founding partner
Natural gas supplier	1. Executive manager
Grape grower	1. Grower
Cardboard boxes supplier	1. External salesman
	1. Market advisor
Bottles supplier	1. Sales manager
	2. Industrial manager
Certification company	1. Certification responsible
Company beta (industry)	1. Administrative director
	2. Technical support manager
	3. Agronomist
Shop and tourism activities[a]	1. Supervisor
Waste processor	1. Commercial director
	2. Chemical engineer

[a] Part of company beta

Figure 3.
Stakeholders interviewed in chain beta

request a customized solution. Therefore, partners of similar size can negotiate on a more equitable basis.

Another similarity supporting eco-innovation is a sustainability orientation as sustainability is a guiding principle for the focal companies. In chain beta, this orientation is mostly present in the focal company; in chain alpha, the focal company looks for similar partners: "We create partnerships with those that already follow the same line of [sustainable] thought" (company alpha).

The focal companies also look for partners that differ in some aspects. Complementary activities (such as transport and commercialization) and resources (such as raw materials and packaging) add value to company's activities. The companies also reach nontraditional members of the chain: an NGO, the government, universities, research institutes and other food companies. The interaction with companies that use similar network resources (but target different consumers) facilitates the exchange of information and technology. Company alpha, for example, exchanges tips and information with noncompeting organic companies at trade fairs; company beta cooperates with a rice producer in a biodynamic production project.

In terms of the organizational heterogeneity of the partners, chain alpha is more homogeneous in terms of values, history and sustainability orientation. Chain beta is more heterogeneous since its line of organic products is just one among many. Company beta does not seem to select its partners according to their sustainable orientation; while company alpha only interacts with organic producers, company beta works with organic and conventional producers. As a consequence, the market does not recognize Company Beta as sustainable: "The term sustainability] is in our mission, in our vision. We want to be recognized as a sustainable company. Today we are not. It has improved. We're conquering it little by little. There's already recognition, but this is far from saying that the [beta] brand is associated with a sustainable company" (company beta).

4.2 Richness

Both chains access rare resources in the organic market, like the grape growers. The transition to organic production is complex and slow, which is a barrier to new entrants. Despite these similarities, the chains extract richness differently. In company alpha, the use of the whole of the grape has made it a pioneer in some products and turned it into a zero-waste industry. Its products are more eco-innovative than company beta's since they have a higher added value and are readily available in the market.

In chain beta, the waste processor uses company beta's grape residues in a product with a lower added value, animal feed: "Today we're only using [the grape waste] [. . .] in a feed formulation that has a low added value. Our goal, for example, is to extract grape seed oil, to make flour from both grape seeds and the peel. And [then] we can create added value for the product" (waste processor, chain beta). Chain beta was also investing in biodynamic certification, which can provide a differentiated product. This focal company associates eco-innovation with anticipating market demands and with benefits for the image (Eiadat *et al.*, 2008).

The performance of company alpha's products seems to have been related to its sustainable orientation since it began. Company beta adopted this perspective later and did not entirely focus on eco-innovation. Another reason may be the internalization of activities by company alpha, which ensures priority to eco-innovative projects.

Contact with consumers is crucial to value creation. Both chains notice a trend toward health and sustainability, which leads to consumers perceiving there to be more value in eco-innovative products: "the consumer's first concern is still with health. [. . .] The second concern is [with] negative externalities [. . .]. I think it's a concern and an opportunity for them [eco-innovative products]. There's also, perhaps, a financial opportunity as a result, – [. . .] a certified organic product [. . .] adds a lot of value" (certification company, chain alpha).

Although many consumers do not understand the meaning of organic and only consider the price, there is a niche of consumers willing to pay a premium for eco-innovative products. Chain alpha has partners with a sustainability orientation that focus on this niche. These partners also provide consumers with information about the value-added element of eco-innovative products: "The point of sale [has to] know how to talk about the product. [It has to know] the reason why [company alpha] grape juice is the best. It's more expensive because it's the best. And why is it the best? And [when] the person [. . .] understands, [the person] buys the idea. Then we realized that it's the point of sale that has to [be responsible for] product turnover" (distributor, chain alpha). Chain alpha retailers, therefore, tell the company's story and promote its products, thereby educating the consumer as to the reason for the higher prices and the advantages of the products. As a consequence, the demand for chain alpha's juice is greater than its supply capacity.

Company beta considers it harder to access this consumer niche. As a consequence, although the company has the potential to increase the production of its organic line, it avoids

doing so because of low demand: "we could have grown a lot more in [the] organic [line], but we didn't because there's no market for it" (company beta). Chain beta, on the other hand, has better access to producers. With 380 associated farming families, it could convince some to become organic. Company beta also has a large physical and management structure at its disposal, which is a limitation for company alpha.

The ability to appropriate network resources in both chains relates to the size and bargaining power of the stakeholders. As mentioned in the reach mechanism, larger partners are not interested in customizing solutions for a small number of products: "today [the bottles supplier] is developing a new juice bottle, and they came here [. . .] to collect information from us, to ask for our opinion, to ask what we think. So sometimes we swap ideas with them too. But do we go and ask them for a solution? Not those big players. It happens more with the small ones" (company beta).

In terms of bilateral and multilateral combinations, there was found to be no complete collaboration involving the supply chain as a whole. Initiatives are mostly bilateral combinations between the focal companies and one of the chain members. Examples of this are helping growers, designing packaging, developing products, exchanging information and developing research.

Chain beta has more combinations for product development. The cardboard boxes supplier suggested changes to company beta's machines, which enabled the inner parts of boxes to be removed, thus reducing the use of materials, costs and waste. Another example is the combination with the waste processor to develop grape by-products. Company beta appropriates knowledge and structure from the waste processor. The waste processor appropriates waste from company beta, which then becomes its raw material. The idea is that when new products are ready, then company beta will use its brand and market access to sell them.

The few multilateral combinations found are promoted by the NGO and government. These combinations involve individuals and organizations in sustainability activities that do not necessarily promote eco-innovative products. However, they help the chains become more aligned and promote the sector, resulting in regional and institutional changes, such as the creation of an organic tourism route in the Vale dos Vinhedos region.

4.3 Receptivity

Stakeholders in both chains expressed their trust in the focal companies. There is also much commitment in both chains, which is apparent in the long-term relationships that exist. The most collaborative relationships are between producers and the focal companies. This is a natural development in company beta since the producers own the company. Because it is a cooperative, it remunerates the producers better, which strengthens and encourages family agriculture and small producers. Organic producers are subsidized to enhance environmental preservation and increase their income and quality of life. Company alpha seems to be as close to its producers as chain beta, and both companies provide growers with technical support and advice.

There are many personal relationships in chain alpha: individuals meeting in the NGO, friendships or when a family member of company alpha is a customer of shop 2 or the restaurant. These two-way relationships, in which suppliers are also customers, strengthen relations and facilitate information exchange.

Chain alpha members that are located in another city (distributor and mini market and restaurant) have a more formal relationship with company alpha. They do, however, have a close relationship with each other and exchange market information and jointly define product mix and placement. They perceive the outcome of the sales to be a shared responsibility. Personal contact, therefore, seems to play an essential role in these

relationships. For companies that are located far from each other, even a visit can increase their commitment to each other.

The focal companies are concerned with developing the chain, especially the development of producers. Company beta's primary concern is with growing continuity over the long term. Organic production is not always actively recommended by the company because it might not be successful and could result in the producer failing: "We're very careful with the producer. For us, the be-all and end-all is the producer. It's not simply the product" (company beta). The main focus of this chain is the *social aspect*.

Company alpha is also close to its producers, but it is not a cooperative, which could put the integration of the chain at risk. It offers only organic products and encourages and supports growers that wish to convert to the organic system. The main focus of this chain is the *environmental aspect*.

In terms of tie multiplexity, chain alpha has more multiple interactions, which embody the personal relationships and friendships that exist between chain members. Chain beta also participates in actions but mainly at the institutional level. The NGO and government have an important role to play in connecting actors. The NGO does not connect with companies but aggregates individuals from different positions in the chain, "from the producer effectively, the transformer, the store, the merchant, the restaurant [. . .]" (NGO, chain alpha). The group shares a common ideal of defending biodiversity and promoting food education, the union of producers and better nutrition. It also develops projects that promote health and sustainability in food production and consumption. The organic tourist route also engages multiple stakeholders. Promoted by the government, it aims to stimulate organic production, to encourage the consumption of organic products, and to add value to them.

Table 4 summarizes the results of the three social capital mechanisms in terms of common results and differences between the chains.

5. Discussion

This paper investigates how chain members collaborate to ensure the sustainability of supply chains through the social capital perspective in a qualitative study with two eco-innovative

Mechanism	General results	Differences between chains
Reach	(1) Mainly dense networks (2) Favorable differences: resources, activities and consumers (3) Unfavorable differences: sustainability orientation, size and location	(1) Chain alpha is more homogeneous in terms of sustainability
Richness	(1) Rare resources of both chains: multiple suppliers and organic certification (2) A niche of consumers willing to pay a premium for eco-innovative products (3) Appropriability seems related to size and bargaining power (4) Most relationships are bilateral (5) Nontraditional members of the chains promote two main multilateral combinations	(1) Company alpha adds more value to grape by-products and has more access to consumers (2) Company beta has more access to producers and infrastructure
Receptivity	(1) Great trust and commitment in both chains (2) Long-term partnerships (3) Personal ties help with receptivity	(1) Chain beta has a greater focus on social outcomes; chain alpha has a greater focus on environmental outcomes (2) Greater tie multiplexity in chain alpha

Table 4.
Results of the three social capital mechanisms (Gulati *et al.*, 2011)

food supply chains in Brazil. The main results concerning social capital mechanisms (Gulati *et al.*, 2011) are as follows: (1) *reach:* focusing on less dispersion in the chain (regional focus) and partners with a sustainability orientation leads to positive sustainability outcomes; (2) *richness:* innovativeness and alignment in sustainability orientation in the chain help create value in eco-innovative products; (3) *receptivity:* strong ties with sustainably oriented partners are crucial for eco-innovations in the chain. Overall, having a similar sustainability orientation is key to addressing sustainability in the chain. The following are some of the results for the mechanisms.

In *reach,* partner alignment concerning the following aspects contributes toward the sustainability performance. The first aspect is having a similar sustainability orientation, which is a consequence of having a managerial sustainability orientation (Pagell and Wu, 2009). Companies created with a sustainability orientation have an advantage since they seek partners with a similar orientation (Isaak, 2002). The second aspect is connecting with local actors. This is a consequence of the sustainability orientation that encompasses a search for social balance in the community (Ashby *et al.*, 2012). It appears, therefore, to be easier to promote social welfare in a chain in which members are geographically close (Sharma and Ruud, 2003). The location also increases *receptivity* since proximity facilitates interaction. The third aspect is being of a similar size. This balances negotiations, facilitates collaboration for sustainability and the appropriation of resources from partners.

Partners that are similar in these aspects seem to be more receptive of eco-innovations. This corroborates the argument that "the organization typically enjoys more straightforward access to the resources furnished by organizationally similar partners" (Gulati *et al.*, 2011, p. 213). Therefore, a proposition from the study is that the conditions that facilitate the development of eco-innovations are having a (1) dense (closer) and homogeneous chain in terms of (2) its size and (3) sustainability orientation.

Other characteristics – such as the resources supplied, activities developed and consumers targeted – increase the *richness* of the network when they *differ* between chain members. A balance needs to be struck between the similarities and differences that support chain goals. To promote sustainability in a chain, it is positive to reach distant partners in terms of resources, activities and consumers but it is even more important to align key elements.

In terms of *richness*, pioneering eco-innovative products can improve market access because of their visibility and utility, as happens in chain alpha. Company beta launched an organic juice later in the market, which might influence the low demand for the product. The company may achieve better results if it becomes a pioneer in biodynamic juices.

Another aspect that helps create value is having a similar sustainability orientation, which promotes eco-innovative products. The whole chain can contribute to this aspect because information flows via different actors until it reaches consumers. The results also provide empirical support for the importance of NGOs as promoters of multilateral combinations for sustainability, in accordance with Hyatt and Johnson (2016) and Johnson *et al.* (2018).

Receptivity is a central and, possibly, the most important mechanism for promoting sustainability in the chain. As with the other mechanisms, a management sustainability orientation is vital since companies that have such an orientation are more receptive to its dissemination. Therefore, receptivity to sustainability depends on management's sustainability orientation.

Another aspect that seems to influence receptivity is the type of ownership. The cooperative (company beta) has a greater receptivity with its grape growers and this leads to a focus on guaranteeing their continuity. The family-run business (company alpha) focuses on eco-innovative products and processes and therefore has a greater receptivity toward chain members more oriented toward environmental outcomes (such as organic grape

growers, distributors, specialized retailers and other nontraditional chain members – NGOs, government, etc.).

When cross-referencing the three mechanisms, an internal factor – sustainability orientation – seems relevant for all of them. A managerial sustainability orientation means that exemplary values guide decision-making and company goals include economic, environmental and social aspects. Sustainability is shared across the organization and is part of the daily conversations (Pagell and Wu, 2009). A previous study in Brazil found that managerial concern with the environment was the second most important internal factor when it came to food companies adopting eco-innovation (Bossle *et al.*, 2016a). The present study, therefore, extends this importance to the chain level, showing that a common internal orientation facilitates collaboration for sustainability at the chain level.

Managerial sustainability and eco-innovation orientations have been investigated and linked in previous studies. Eiadat *et al.* (2008) suggested that managerial concerns with the environment could drive firms in the chemical industry to adopt an eco-innovation strategy. The concerns of top management, therefore, are fundamental for the adoption and integration of eco-innovation in companies' strategies (Bossle *et al.*, 2016b). When such orientation is a central aspect of the company since its creation (company alpha), members of the chain are also selected according to sustainability criteria. When sustainability is one strategy among others (company beta), members of the chain are selected according to more traditional criteria. In this way, the chains end up with different configurations, with chain alpha being more consistent in terms of sustainability and consequently having a greater receptivity toward this matter. Hence, this paper proposes that a managerial sustainability orientation is an important driver for the adoption of eco-innovations and for chain sustainability.

Sometimes the lack of alignment between the richness and receptivity mechanisms hinders sustainability in the chain: rich resources may not be channeled into the focal companies or strong receptivity may not translate into access to richer resources (Gulati *et al.*, 2011). Company beta, for example, has a strong receptivity with the waste processor – but not very rich because it has not yet developed the desired products. The bottles supplier has resources to produce customized bottles – but it is not receptive to the focal companies. The companies have little to offer in exchange for customized packaging as their demand for bottles is insubstantial. In this case, the ability to uncover some of the resources of this partner would help create value (Gulati *et al.*, 2011).

In terms of how the types of ties affect social capital mechanisms (Gulati *et al.*, 2011), personal ties seem to be positive for promoting sustainability. Company alpha is more successful in terms of sustainability, and a factor that may explain this is the greater receptivity of the chain, supported by personal relationships. Institutional arrangements also support multilateral sustainability combinations, emerging as a meaningful integration of different members of the chain, according to SSCM literature (Van Hoof and Thiell, 2014; Neutzling *et al.*, 2018). Therefore, strong personal ties and multilateral combinations seem to increase the receptivity of sustainability.

In short, the operational decision to manage a collaborative supply chain for sustainability requires capabilities and intangible resources. This is an important factor for operations managers to take into account when making decisions.

6. Conclusions, implications and limitations

This paper contributes to an understanding of collaboration within SSCM by presenting empirical evidence about the social capital mechanisms of eco-innovative supply chains for sustainability. We adopted an expanded view of collaboration, involving multitiers and stakeholders to analyze local relationships and contributing by way of empirical data of different stakeholders in two food chains in a developing country.

From the viewpoint of social capital, the study contributed by empirically investigating the three social capital mechanisms proposed by Gulati *et al.* (2011). The paper shows how different types of companies collaborate in their supply chain for sustainability and that sustainable chains presuppose a close-knit network, in which there is a great affinity between the members. It means that operations managers not only improve their green performance for environmental benchmarking but also expand throughout the chain. Social capital mechanisms can lead partners to develop strategic initiatives for sustainability, especially if managers share key drivers for adopting eco-innovation and measures that ensure the sustainability of the chain as a whole.

In terms of research implications, social capital theory and, specifically, the typology by Gulati *et al.* (2011) were an appropriate lens for studying SSCM and collaboration. The study provides empirical results corroborating the importance of collaboration in supply chains for sustainability. A managerial sustainability orientation at the internal level emerged as the main requirement for aligning orientation along the supply chain and should, therefore, be explored in future studies.

In terms of practical implications, recommendations can be made for managers who want to invest in more eco-innovative practices in the chain. First, the *richness* in the chain needs to be sought out, and the following questions answered: what resources could add value to eco-innovation? And what more does the company need to be able to develop eco-innovation successfully? The answers will vary from company to company since it depends on the internal resources available. Next, it is necessary to be connected to (*reach*) partners that have these resources. Eco-innovation should prioritize local partners. *Receptivity* underpins the process – a common orientation for sustainability is the basis for the development of eco-innovations. A core implication is that managers investing in sustainability/eco-innovation should not only invest in an internal managerial sustainability orientation (Pagell and Wu, 2009) but also find partners that have a similar orientation.

Companies have control over internal factors, like their sustainable orientation and choice of partners, which facilitates the transition to more sustainable chains. It is also important, however, to point out that there are macro-level issues to achieve a more sustainable system that companies, chains or networks alone do not have control over (Johnson *et al.*, 2018). Although it was not the focus of the study, interviewees emphasized the difficulties arising because of a lack of institutional support. A real shift toward sustainability must be underpinned by an enabling policy environment (Johnson *et al.*, 2018), so that major changes for sustainability take place. Governments that want to support sustainability transitions, therefore, should also invest in a macro-environment that facilitates them.

In terms of limitations, this study was conducted in the Brazilian food sector and investigated a limited number of cases. The qualitative design of the study has its own, acknowledged methodological limitation since it restricts the results being generalized and applied to other contexts and sectors (De Oliveira *et al.*, 2019). Future studies could investigate other sectors and countries. They can also investigate collaboration for sustainability in related areas, such as collaboration in circular supply chains (Daddi *et al.*, 2019; Farooque *et al.*, 2019; De Oliveira *et al.*, 2019).

The present research gave an example of the engagement of the public sector, grape growers, companies and an NGO for promoting sustainability actions, in an attempt to make changes at the institutional level. This can, however, be considered an isolated solution in the Brazilian reality. Future studies may investigate actions for promoting sustainability and eco-innovation at the macro-level (Johnson *et al.*, 2018).

Notes

1. The questionnaire adopted the following definition of eco-innovation: eco-innovation (environmental, sustainable or green innovation) is the development or implementation of (new)

products, processes or services that create environmental benefits. Eco-innovation can be achieved through concerns with basic ingredients (organic, free-range), packaging (i.e. recyclable), manufacturing processes (energy saving, water recycling), logistics or distribution (new channels or direct consumer sales, etc.), certifications (traceability or origin, eco-labels, fair and solidarity trade, ISO 14001) and commercial aspects (low-carbon footprint, etc.) (Bossle, 2015; Bossle *et al.*, 2016a).

2. The following eco-innovation options were presented in this question: (1) adoption of certification (organic, bio, Demeter, biodynamic); (2) adoption of traceability or origin labeling; (3) selling or production of fair-trade and solidarity products; (4) production of meat and/or eggs from free-range animals; (5) adoption of recyclable or ecological packaging; (6) adoption/preparation of environmental reports; (7) environmental management and auditing systems: formal environmental management systems for measuring, reporting and designating responsibility for dealing with issues related to the use of materials, energy, water and waste, e.g.: EMAs and ISO 14001; (8) reduction of material use per unit of output within my enterprise; (9) reduction of energy use per unit of output within my enterprise/adoption of renewable energy; (10) reduction of CO_2 footprint (reduction of total CO_2 production) by my enterprise; (11) replacement of materials with less polluting or hazardous substitutes within my enterprise; (12) reduction of water, air pollution, soil or noise within my enterprise; (13) management and recycling of waste, water or materials within my enterprise; (14) sustainable distribution channels (Bossle, 2015; Bossle *et al.*, 2016a).

3. No company selected 14 eco-innovations; therefore, those companies that selected 12 or 13 options were considered the most eco-innovative.

4. The script presented the Organization for Economic Co-operation and Development (OECD) definition of eco-innovation: "the development of products, processes, marketing methods, organizational structure, and new or improved institutional arrangements, which, intentionally or not, contribute to a reduction of environmental burdens in comparison with alternative practices" (OECD, 2009, p. 2). It also gave examples of eco-innovation in the food sector according to the questionnaire of Bossle *et al.* (2016a) (see endnote 2).

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