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Collaborative Mechanisms for Sustainable Supply Chains: A Systematic Literature Review

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Abstract. Whether from government policies, customer expectations or personal beliefs, there is increasing pressure on firm's and their supply chains to adopt sustainable practices. The concept of sustainability in supply chains has therefore attracted the attention of academia and industry. Most research states the importance of collaboration with upstream and downstream entities as a critical success factor when aiming for a sustainable supply chain and proposes various collaborative mechanisms to enable firms in the implementation of a sustainability initiative. The goal of this paper is to investigate the role of collaboration in these initiatives and explore the proposed collaborative mechanisms via a systematic literature review method. This systematic mapping of the field provides a classification of previous publications, categorizes the collaborative mechanisms, and highlights the role played by these mechanisms when deploying sustainable supply chains.

Keywords. Supply Chains, sustainability, collaboration, systematic literature review.

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1. Introduction

As the interest for sustainable development gains importance in the public eye, the pressure on businesses to adopt sustainable management practices in their own organisation as well as within their supply chain is increasing. The pursuit for a sustainable supply chain often faces challenges in its attempts to satisfy the triple bottom-line (economic, environmental, and social aspects). Walker *et al.* (2008) identified some of these barriers as cost concerns, lack of training as well as lack of stakeholder or supplier commitment. Businesses which choose to integrate environmental and/or social aspects in their supply chain management will then need to identify enablers to help them overcome these challenges. Walker *et al.* (2008) and Diabat and Govindan (2011) both reviewed the literature in order to identify these enablers. Among all potential enablers of efficiency and sustainability they mention, this research focuses on collaboration as one of the key factors to adopt.

Collaboration has long been recognized as a key factor in traditional supply chain management (Barratt, 2004; Lehoux *et al.*, 2014). Collaboration, as defined by Audy *et al.* (2012), involves two or more parties exchanging or sharing resources in the hopes of creating a synergy that generates benefits greater than what could be achieved individually. In traditional supply chain management (SCM), the benefits considered are usually strictly economic and all partners will readily see the advantages for their business. Green and sustainable SCM entail multi-stakeholder initiatives as well, however, they are slightly different as they include environmental and/or social considerations, sometimes to the detriment of economic benefits. Addressing specific sustainability issues might also require the involvement of new businesses in the supply chain, but all of the entities in the current supply chain as well as the new comers might not necessarily have attained the same level of sustainability. Hence, the importance of aiming for well-defined objectives through collaboration.

Over the years, several researchers have addressed the role of collaborative activities in green or sustainable supply chains such as Vachon and Klassen (2008), Gold *et al.* (2010), Blome *et al.* (2014), Waller *et al.* (2015), and Chin *et al.* (2015). While scholars and practitioners agree on the critical role of collaboration in these supply chains, they do not seem to highlight the collaborative mechanisms that businesses could implement to enable this collaboration such as methods, tools, processes, systems, etc. Furthermore, to the best of our knowledge, no previous research has proposed a comprehensive literature review on the role of collaboration and collaborative mechanisms in sustainable SCM specifically. It should be noted that, in this research, the authors considered all references to collaboration in a green, environmental or sustainable supply chain management context to be relevant to sustainable SCM.

Therefore, this research aims to investigate the usefulness of collaboration in the quest to improve the sustainability of supply chains through a structured literature review (SLR) and to identify the collaborative mechanisms that enable this collaboration. For this SLR, a set of keyword combinations relating to supply chains, collaboration, and sustainability were systemically searched in specific fields of selected search engines. Based on this SLR, more than 190 articles from 37 countries were found and analyzed in order to identify the methodology used as well as the collaborative mechanisms considered in the research. A total of 715 collaborative mechanisms were found in 187 of the articles. A classification exercise led to the identification of seven broad categories of collaborative mechanisms: relationship management, contract and economic practices, joint practices, technology and information sharing practices, governance practices, assessment practices, and supply chain design. Results showed that the top five most frequently mentioned collaborative mechanisms, in decreasing order, are contracts, economic incentives, communication, information sharing,

and integration. In almost all of the contributions, authors proposed a combination of collaborative mechanisms from several categories. This article contributes to confirm the usefulness of collaborations in sustainable supply chains while demystifying the role played by specific mechanisms to support the collaboration process.

This paper is structured as follows. Section two presents the methodology used for the structured literature review. Section three addresses how collaboration supports sustainable SCM. Section four describes the collaborative mechanisms found in each category based on the literature review analysis. Section five presents a discussion concerning the mechanisms and their deployment. Section six proposes a conclusion.

2. SLR Methodology

The purpose of this research is to investigate the role of collaboration in improving the sustainability of supply chains and to identify the collaborative mechanisms that enable this collaboration. To reach this goal, a systematic literature review analyzing the existing research was conducted. This method allowed us to identify the scope of the review, select a certain number of criteria, and specify a set of questions to answer. Inspired by the approach proposed by Tranfield *et al.* (2003), the following steps were followed. First, a set of research questions were identified. Then, a set of preliminary "Keywords", "Search field", and "Engine" were selected. After performing a trial search and evaluating the preliminary set, the best fit terms and locations for the research were found. Thirdly, a set of papers regarding the predefined criteria and research questions were selected and assessed. Finally, the results were synthesized and descriptive statistics and findings of research proposed.

2.1 Research questions

To reach the goal of the research, three key questions had to be addressed:

Q1- Is collaboration useful to improve the sustainability of supply chains?
Q2- How did each study come to this conclusion (i.e. methodology followed)?
Q3- What collaborative mechanisms are proposed to enable this collaboration?

2.2 Research keywords, search fields, and databases

In order to define a suitable set of keywords, search fields, and databases, a trial search was done by testing different keywords and search engines. This preliminary step helped us enrich the research by selecting and validating the right criteria that would lead towards a more comprehensive investigation.

Consequently, in this research we investigated a set of electronic databases encompassing: "Google Scholar", "Elsevier Science Direct", "Wiley Online", "Sage Online", "JSTOR", and "Springer link". To narrow the research field and select the most relevant studies, we established 32 triads of keywords that were searched in the following fields of each database: "Title", "Keyword", and "Abstract". The keyword "Supply chain" was in each triad. The second keyword in the triad was either "Collaboration", "Partnership", "Alliance", or "Collaborative". The third keyword in the triad was either "Sustainable", "Sustainability", "Green", "Environmental", "Social", "Economic", "Benefit" or "Financial".

2.3 Assessment and selection criteria

In order to make sure that the papers found would be relevant for the study, the abstract and the conclusion were first studied to see if they contained the answer to the pre-defined questions. For validity and reliability purposes, the entire content of the paper was next scanned to see if it encompassed at least one of the following terms in each subset:

1- Sustainability, resilience, long-term, or long-run;
2- Environmental, energy, carbon, gas emission, pollution, fossil, fuel, solid waste, green, footprint, or animal welfare;
3- Social, security, health, education, housing, equity, population, human rights, worker, staff, labor, safety, or job creation; and
4- Collaboration, collaborative, partnership, integrated, alliance, cooperation, or relationship.

Other key terms regarding collaboration and collaborative mechanisms such as information sharing, horizontal versus vertical collaboration, joint planning, etc., were also taken into account.

2.4 Results synthesis and report

From the extensive number of papers found, 190 papers answered the requirements. Of these papers, 187 presented specific collaborative mechanisms. Table A1 (Appendix A) presents the 190 papers that address the role of collaboration in improving supply chain sustainability.

Figure 1 demonstrates the number of relevant papers published per year. As this figure shows, the importance of research on collaboration in sustainable supply chains has increased prominently during recent years. The number of papers in 2017 is lower than 2016 as this literature review was completed in January 2017.

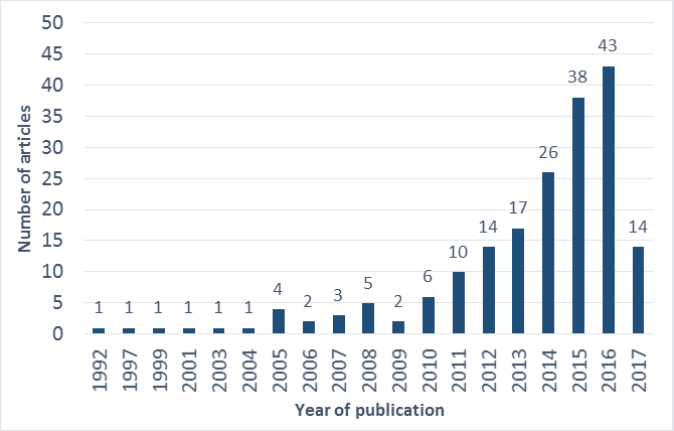

Fig. 1. Distribution of reviewed articles based on the year of publication (review completed on 2017-01-25)

Figure 2 illustrates the distribution of papers regarding the country of origin of the first author. As this figure reports, they come from 37 different countries. However, the majority of the studies were done in the USA (33 studies), followed by the United Kingdom (17 studies), and China (13 studies).

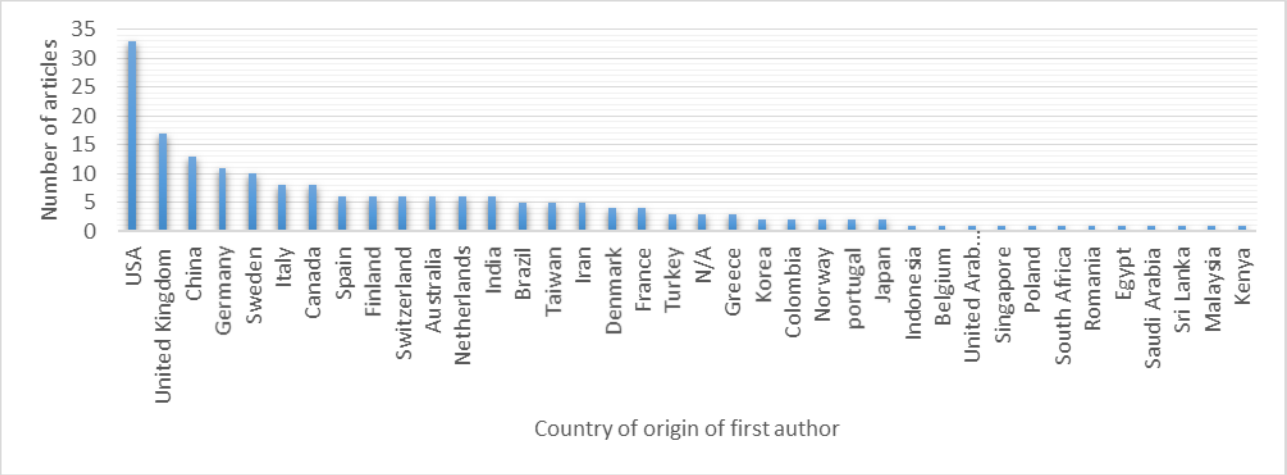

Fig. 2. Reviewed articles based on the country of origin of the first author

The next section presents the answers to the first and the second questions of the research based on all the relevant papers found.

3. Collaboration to enable sustainability of supply chains

The first and the second questions of the present research, which were to verify the usefulness of collaboration in supply chain sustainability initiatives and the methodology used to support the demonstration, can now be addressed. In this article, we consider a supply chain sustainability initiative to be a long-term arrangement involving at least two partners.

3.1 Collaboration in supply chain sustainability initiatives

The systematic literature review that was conducted identified 190 papers recognizing that collaboration had indeed played a role in implementing a supply chain sustainability initiative. For example, Aschemann-Witzel *et al.* (2017) studied the key success factors for supply chains trying to reduce consumer-related food-waste by analyzing 26 existing initiatives. All actors declared that collaboration was of vital importance to the success of their initiatives on reducing consumer food-waste. Reefke and Sundaram (2017) used the Delphi method to survey 15 academics and 20 industrial practitioners on the key enablers of sustainable supply chains and collaboration was found to be a central element. Gimenez *et al.* (2012) analyzed data from a survey of 519 assembly plants from 17 countries and determined from their responses that supply chain collaboration has a statistically significant impact on economic, environmental, and social performance.

Furthermore the different articles investigated highlighted the fact that the collaboration may take multiple inter-organizational forms depending on the sustainable goals pursued by the actors. Some sustainability initiatives involve current supply chain partners, such as reducing greenhouse gas emissions by coordinating with suppliers for optimized deliveries, and may therefore be referred to as **vertical collaboration** (Amer and Eltawil, 2014; Gavronski *et al.*, 2011; and 6 other papers). Other sustainability initiatives rather involve partners who are not within the supply chain, such as reducing greenhouse gas emissions by integrating collaborative consolidation centers shared with other firms, which is referred to as **horizontal collaboration** (Patala *et al.*, 2014; Solakivi *et al.*, 2013; and 4 other papers).

If the firm decides to implement a sustainability initiative with partners from academia, government, non-governmental organizations (NGOs), third-party logistics (3PLs) or other firms in the search for expertise outside of its field, authors in the literature refer to this type of collaboration as **cross-sectoral** (Pehlken *et al.*, 2016; Sahamie *et al.*, 2013; and 6 other papers). For example, Pehlken *et al.* (2016) point out that to implement their sustainable bioenergy solution, one of the main elements is to identify the right actors and to build a strong collaboration between them (e.g. a farmer to provide biomass, a biogas producer, and a bioenergy consumer).

Other types of collaboration have also been mentioned in the literature on sustainable supply chain collaboration, such as **global network collaboration** and **cross-border collaboration** for initiatives involving partners from other countries (Seuring and Gold, 2013; Zander *et al.*, 2016; and 2 others). Tsoi (2010) mentions that language may be an issue to address in these collaborative partnerships. Some also mention **cross-functional collaboration**, especially intra-firm, for initiatives involving employees with different capabilities (Laarie *et al.*, 2016; Ramanathan *et al.*, 2014; and 2 others). Similarly, **inter-disciplinary collaboration** refers to the need for each partner in the initiative to use their specific expertise (Kulak *et al.*, 2016; Sahamie *et al.*, 2013).

We therefore conclude that collaboration is indeed useful to improve the sustainability of a supply chain, that it has been recognized as such by academics as by the industry, and that it may take multiple inter-organizational forms depending on the context considered.

3.2 Analysis of the methodologies found in this SLR

Concerning the methodology followed by the authors to demonstrate the collaboration usefulness in sustainable supply chains, we were able to classify them into five groups: case study, mathematical and simulation modeling, qualitative methodology, quantitative methodology, and structured literature review. The case study group is dedicated to empirical research that targeted a phenomena within an industry or a company. Mathematical and simulation modeling considers research that focused on modeling the problem via mathematical modeling, optimization or simulation framework. Quantitative methodology introduces articles that applied statistical analysis, footprint calculation, conceptual frameworks, etc. The qualitative methodology group is allocated to research that explored the reasons and motivations to answer specific problems based on interviews, observations, discussions etc. The structured literature review addresses articles reviewing previous research and their results to answer predefined research questions and highlight future research avenues. Figure 3 presents the distribution of papers according to the applied methodologies of the authors' research and the year of the publication.

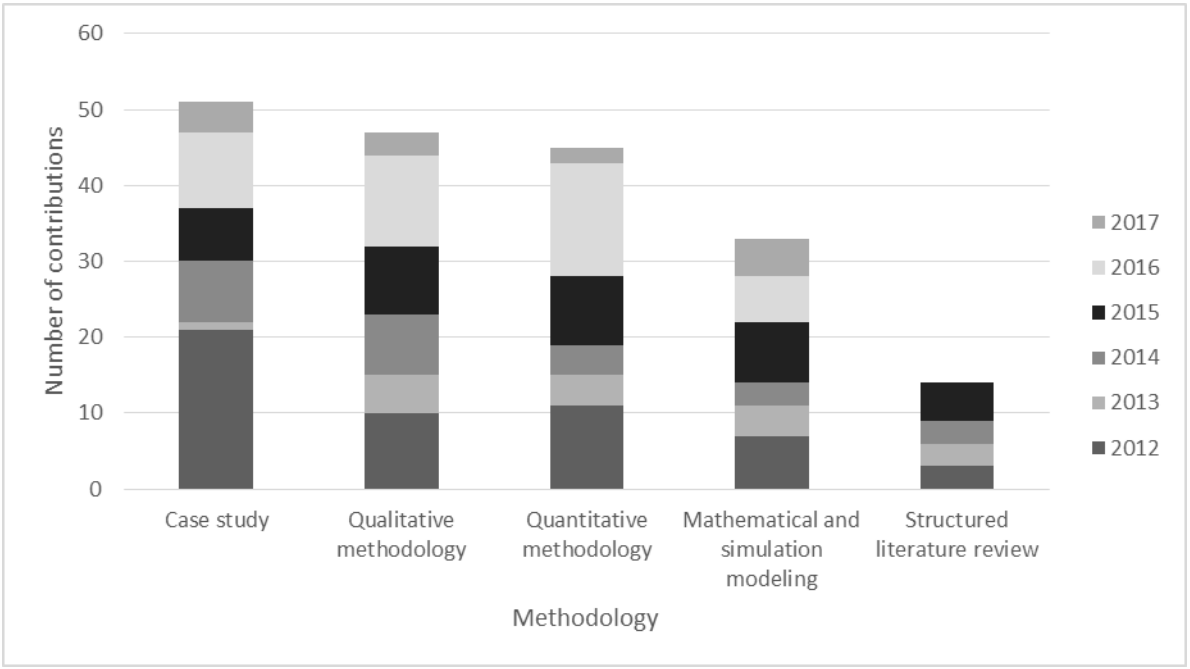

Fig. 3. Distribution of reviewed articles based on the methodology and the year of publication

As we can see in this figure, prior to 2015, many studies had applied a case study approach, confirming the interest for companies to find a practical way to achieve higher sustainability goals and the interest for academics to see how they were doing it. However, since 2015, most of the studies have been using qualitative or quantitative methodologies so the distribution in these three methodologies is now more uniform. We also note an increase in contributions using a mathematical or simulation modeling methodology in recent years.

4. Collaborative mechanisms

The third question to answer with this research concerned the collaborative mechanisms that supply chain members could adopt to improve their supply chain sustainability. Regarding this issue, 187 of the 190 papers proposed the use of at least one collaborative mechanism. Based on the variety of mechanisms proposed by the authors, it can be concluded that companies can collaborate through a vast spectrum of methods. In all, a total of 715 collaborative mechanisms were mentioned. Although many seemed to be recurring, at first glance it was difficult to see through this cloud of mechanisms to identify patterns or trends. Therefore, our first step was to sift through all of the collaborative mechanisms to attempt a categorization. Some more general collaborative mechanisms such as joint practices or information sharing were mentioned in several contributions. Other authors preferred to target more specific mechanisms which seemed to belong to more general categories. For example, joint forecasting and joint planning seemed to be specific instances of joint practices. Likewise, integration of IT solutions and exchanging transactional information seemed to be part of information sharing. The classification exercise revealed certain trends.

Hence, the vast spectrum of collaborative mechanisms found in this SLR was classified into these seven collaborative mechanism categories:

i) Relationship management (RM);
ii) Contractual and economic practices (CEP);
iii) Joint practices (JP);
iv) Technological and information sharing practices (TISP);

v) Governance practices (GP);
vi) Assessment practices (AP); and
vii) Supply chain design (SCD).

Each category is defined below with examples of specific mechanisms and their roles in sustainable supply chains.

4.1 Relationship management

Inspired by Forkmann *et al.* (2016), the collaborative mechanisms in this block are dedicated to activities, organizational processes or routines that facilitate the management of relationships among stakeholders. These mechanisms help raise awareness for sustainability and maintain or increase the support from top management, employees, suppliers, customers, and other stakeholders to address potential issues.

Relationship management seems to be key to successful collaboration since at least one collaborative mechanism in this category is mentioned by almost 80% of the contributions in the SLR. Of these, 30 contributions simply mention the importance of maintaining a good relationship with the other parties involved in the initiative (Koh *et al.*, 2012; Laari *et al.*, 2016; and 28 others).

Communication is one of the main mechanisms in the RM category as it is seen as the foundation of successful collaborative partnerships (Acquaye *et al.*, 2015; Adams, 2008; and 65 others). Communication is also needed to raise awareness, whether it be for suppliers, customers, employees or other stakeholders (Davidson *et al.*, 2014; Gallear *et al.*, 2015; and 12 others). Specific mechanisms used to communicate in a formal or informal manner are meetings, exchange venues, and networking (Bisogno, 2016; Dangelico *et al.*, 2013; and 18 others) whereas more structured mechanisms such as training sessions, workshops, seminars, and education may also be used (Cao *et al.*, 2017; Dai *et al.*, 2015; and 18 others).

The second main mechanism in the RM category is integration (Matt *et al.*, 2014; Molina-Besch and Pålsson, 2016; and 55 others). Interaction, which seems to require less effort than integration, is a collaborative mechanism mentioned by a few authors (Egels-Zandén *et al.*, 2015; Hazelton *et al.*, 2013; and 3 others). Increasing the interaction between collaborating parties could indeed be an effective way of evolving from a collaborative partnership with efficient two-way communication to a completely integrated, smooth-running operation. Integration seems to lead to a deeper collaboration involving other mechanisms such as learning from other companies (Dale *et al.*, 2016; Fiorino and Bhan, 2014; and 7 others), acquiring their knowledge and skills, or developing new ones together (Aschemann-Witzel *et al.*, 2017; Rizzi *et al.*, 2013; and 2 others). According to Gunasekaran *et al.* (2015), green integration is achieved when collaborators align their sustainability goals and create a synergy through synchronized actions.

Another key collaborative mechanism for the success of a sustainability initiative is motivation (Airike et al, 2016; Hall *et al.*, 2013; and 6 others). Collaborative mechanisms that will nourish this motivation are the firms' commitment to the partnership (Leadbitter and Benguerel, 2014; Pimenta and Ball, 2015; and 2 others) and partnership support (Aguiar *et al.*, 2013; Maloni and Benton, 1997; Pimenta and Ball, 2015) such as sponsoring meetings for suppliers to share information (Sancha *et al.*, 2016) or investing in formal relationship building activities (Touboulic and Walker, 2015). Several contributions mentioned that the relationship should be built on a mutual understanding (Bernstein and Cashore, 2007; Blome *et al.*, 2014; and 14 others) and shared values (Reefke and Sundaram, 2017).

Finding the right collaboration partner is also vital to a sustainable collaborative relationship. When a firm must find the right partners to implement a new sustainability initiative, several authors identified joining collaboration networks or associations as an efficient collaborative mechanism (Dangelico *et al.*, 2013; Fischer and Pascucci, 2017; and 7 others). As a specific example, O'Keefe *et al.* (2016) describe how the Great Deal network, designed to encourage energy efficiency measures in the United Kingdom, is used to bring potential business partners together. A few contributions describe the relationship characteristics that could lead to good collaboration, such as mutual trust (Dan *et al.*, 2010; Li and Found, 2016; and 5 others), goodwill and openness (Gunasekaran *et al.*, 2015; Maloni and Benton, 1997; Wan Ahmad *et al.*, 2016), transparency and proactive behaviour (Wan Ahmad *et al.*, 2016), flexibility and solidarity (Dan *et al.*, 2010), organizational compatibility (Youn *et al.*, 2013) as well as a mentality to embrace change (Reefke and Sundaram, 2017).

4.2 Contractual and economic practices

Contracts can be conceptualized as any written or spoken and legal agreement among stakeholders. A contract forces all parties to accept their responsibilities and respect their promises (e.g. a cost-profit sharing contract between a manufacturer who must invest in the design of an eco-product and a retailer who will profit from selling it). Economic practices such as incentive alignments, rewards, and cost-profit sharing are also included in this category. The mechanisms in this category will help motivate long-term and steady collaboration between companies as well as clearly indicate expectations from each party.

Establishing a legal contract is a collaborative mechanism mentioned in 95 contributions which represents 50% of the selected papers. Most simply refer to contracts in general (Shanoyan *et al.*, 2014; Tarandi, 2015; and 36 others). However, some refer to agreements (Mengistie *et al.*, 2015; Nwaka, 2005; and 33 others), revenue sharing contracts (Jakhar, 2015; Klassen and Vachon, 2003; and 3 others), cost sharing contracts (Ghosh and Shah, 2015; Tesfay, 2014; Yenipazarli, 2017), long-term contracts (Bai *et al.*, 2012; Cheung *et al.*, 2009; Davidson *et al.*, 2014), multilateral contracts (Brown *et al.*, 2007), and joint ventures (Roy and Whelan, 1992; Umar *et al.*, 2013; and 5 others).

Economic practices are also collaborative mechanisms frequently mentioned in this category, some form or other being mentioned in 91 contributions. Economic incentives, a more general term, is by far the most frequently mentioned (Sime, 2005; Sippl, 2015; and 56 others). Other, more specific types found in the literature are sharing benefits (Koh *et al.*, 2012; Maloni and Benton, 1997; and 12 others), cost-profit sharing (Amer and Eltawil, 2014; Basiri and Heydari, 2017; and 2 others), incentive alignment (Brockhaus *et al.*, 2013; Nematollahi *et al.*, 2017b; and 2 others), and rewards (Formentini and Taticchi, 2016; Hussain *et al.*, 2015; Maloni and Benton, 1997).

For example, Ding *et al.* (2015) studied the pricing strategy of sustainable supply chains and explored a mechanism to motivate supply chain actors to produce environmentally green products. Via a mathematical modeling methodology, and by applying regulation and policy incentives, they showed that cooperation of supply chain actors enhance environmental performance through collaborative adjustment of transfer price considering government policy incentive.

4.3 Joint practices

In this research, joint practices address common, bilateral, and mutual activities among the parties involved. The spectrum of cooperation practices ranges from joint planning up to joint control activities (Mentzer, 2001). The mechanisms in this category facilitate collaboration because they rely

on the knowledge and the expectations of all parties involved to establish a consensus to which all parties will adhere to, be it a common production plan, a common forecast, etc.

Of the contributions analyzed in this SLR, 122 papers mentioned a collaborative mechanism in the JP category. Some authors referred to it as joint-effort, joint-execution, and cooperation (Brockhaus *et al.*, 2013; Burlingame and Pineiro, 2007; and 42 others). Some others mentioned the importance of having all parties participate in planning the initiative (Albino *et al.*, 2012; Fischer *et al.*, 2016; and 17 others), joint solution finding (Airike *et al.*, 2016; Gold *et al.*, 2010; and 10 others) as well as collaborative decision-making (Basiri and Heydari, 2017; Chan *et al.*, 2012; and 15 others). Several authors also specify that for the collaboration to be successful, the parties involved must share a common goal that is clear to all (Cheung *et al.*, 2009; Dale *et al.*, 2016; and 24 others).

This category also includes the concept of sharing. Many authors mention that sharing activities (van Hoof and Thiell, 2014; Vrijhoef *et al.*, 2014; and 3 others), sharing resources (Hajdul, 2014; Nathanail *et al.*, 2016; and 4 others), and sharing processes (Akhavan and Beckmann, 2017; Chan *et al.*, 2012) can enhance collaboration between the actors of a sustainable initiative. We also consider that developing mutually beneficial capabilities, found in 11 contributions such as Gallear *et al.* (2015) and Kovács (2008), is a collaborative mechanism in the JP category.

A few authors target specific sustainability initiatives and are then able to propose more precise JP mechanisms. For example, two firms could collaborate on an eco-product development initiative (Gunasekaran *et al.*, 2015; Kulak *et al.*, 2016; and 12 others). Kulak *et al.* (2016) takes this concept further and proposes mechanisms such as integrative design and a collaborative design workshop. Similarly, a firm could collaborate with suppliers to ensure eco-sourcing (Teixeira *et al.*, 2016; Yan *et al.*, 2016; and 3 others), help the supplier develop to meet sustainability standards (Akhavan and Beckmann, 2017; Wan Ahmad *et al.*, 2016) or even manage delivery schedules and routes together (Siddiqui and Raza, 2015; Tseng and Bui, 2017). In the hopes of reducing inventories, warehouse sizes, energy consumption, greenhouse gas emissions and/or waste in general, supply chains may aim for more sustainable operations management. Some of the JP mechanisms proposed in this case are collaborative forward flow of products (Amaro and Barbosa-Póvoa; 2013; Gunasekaran *et al.*, 2015; Ytterhus *et al.*, 1999) which might benefit from joint forecasting or joint production planning (Chkanikova, 2015; Jiang *et al.*, 2016; and 4 others) and synchronization (Musa *et al.*, 2014; Reefke and Sundaram, 2017; and 3 others). A specific example of joint planning is given by Réviron and Chappuis (2005) where a popular food chain in Switzerland has partnered with a meat producer association in order to guarantee quality of meat and reduce food loss. The association and the food chain executives meet regularly to discuss the quantity of meat to produce. Furthermore, both agree on a monthly quantity that the food chain accepts to purchase from the meat producers.

4.4 Technological and information sharing practices

This category is based on the definition of Montoya-Torres and Ortiz-Vargas (2014) who describe collaboration and information sharing in supply chains and defined technological and information sharing practices as the activities, data, and tools used in facilitating the procedure of collaboration among different entities of a supply chain. The collaborative mechanisms in this category aim to facilitate the collaboration in sustainability initiatives by providing relevant and accurate information when it is needed. The relevance, accuracy, and timeliness of the information shared will depend on the collaborative mechanisms that are put in place.

Information sharing is the most frequently mentioned collaborative mechanism in this category. A total of 69 contributions emphasized its importance (Acquaye *et al.*, 2015; Barari *et al.*, 2012; and

67 others). Some authors also indicate knowledge sharing (Fischer and Pascucci, 2017; Gallear *et al.*, 2015; and 14 others) to deepen collaboration. Whereas information sharing could refer to simple data exchange, knowledge sharing implies transferring or teaching abilities and know-how that would require closer collaboration.

As for technological collaborative mechanisms, several authors address the need for an information system or a platform allowing for easy exchange of data (Brown *et al.*, 2007; Chenga, 2011; and 39 others). These two contributions, along with 7 others, specify that if there are many systems, they should be integrated with seamless communication between them. Among the technological collaborative mechanisms mentioned by contributions in this SLR, the most frequent are a standardized model for visualizing and sharing information (Hu *et al.*, 2015, Klassen and Vereecke, 2012; Kurdve *et al.*, 2015; and 3 others), data harmonization and analytics (De Souza *et al.*, 2014; Fischer *et al.*, 2016; and 2 others), ensuring the quality of the information exchanged (Le Dû and de Corbière, 2011; Li and Found, 2016; Waller *et al.*, 2015) as well as providing technical assistance to all parties involved (Dai *et al.*, 2015; Hall *et al.*, 2013; Sigala, 2008).

Once again, studies focusing on specific collaborative sustainability initiatives mention the use of more precise technological collaborative mechanisms such as a product information system (Boström *et al.*, 2015; Waller *et al.*, 2015), an intelligent transportation system (Bucklew, 2011), an e-commerce platform (Goyal *et al.*, 2017; Jiang *et al.*, 2016; Musa *et al.*, 2014) or a website-forum (Kumar and Malegeant, 2006; Hall *et al.*, 2013). For example, Schniederjans and Hales (2016) mention cloud-computing as a collaborative mechanism. They surveyed 247 IT and supply chain professionals and concluded that cloud computing can indeed be used to positively impact collaboration, and is positively associated with both economic and environmental performance.

4.5 Governance practices

The collaborative mechanisms related to governance practices address rules, trends, policies, and administrative laws that control, direct or manage the activities, organizations, and systems. Decision makers of private sectors also might define a set of policies, guidelines, and standards, with respect to public policies, to manage and make decisions regarding the contexts, events, and interactions among stakeholders. These collaborative mechanisms facilitate collaboration in sustainability initiatives as they help specify the common goals and the responsibilities of each party. Establishing policies and standards may also help in having a higher level of process consistency, innovation, responsiveness and transparency, better costs and benefits alignment, and more efficient environmental monitoring.

Of all the contributions in this SLR, 105 mentioned a collaborative mechanism from this category. These mechanisms can be separated into two main groups: i) governance from external entities such as the government or environmental organisations and ii) governance from within the partnership such as internal sustainability standards and practices.

To begin with, several authors mentioned governance as an efficient collaborative mechanism without necessarily indicating whether it was external governance, internal governance, or both (Bernstein and Cashore, 2007; Gold *et al.* 2010; and 16 others). However, Boström *et al.* (2015) do specify that they consider governance to be guidelines, rules, norms, standards, and exercising authority while sustainable governance refers to eco-labels, codes of conduct, procurement guidelines, and eco-branding.

The external collaborative mechanisms that we found are government policies, regulations and legislation (Halloran *et al.*, 2014; Iacob, 2015; and 8 others), government subsidies (Ellram and Golicic, 2016; Forsman *et al.*, 2014; and 4 others), government policy incentives (Ding *et al.*, 2016a; O'Keefe *et al.*, 2016; Yan *et al.*, 2016), government sponsored training (Cao *et al.*, 2017; Tseng and Bui, 2017), NGO supplier development programs (Rodríguez *et al.*, 2016), adhesion to international initiatives such as Global Compact (Formentini and Taticchi, 2016), and any other help received from the government, agencies, and the community to support the sustainability initiative such as funding, data or information (Tseng and Bui, 2017).

As an illustration, Korhonen *et al.* (2015) studied the role of environmental regulations in the future competitiveness of the pulp and paper industry through a qualitative methodology. The regulatory measures were perceived as environmentally advantageous and effective in the long term. The role of the policy implementation in achieving actual environmental improvement was also emphasized.

The most frequent internal governance collaborative mechanism is establishing standards (Adams, 2008; Brown *et al.*, 2007; and 54 others) to set the performance levels that are expected from each party. Other recurrent collaborative mechanisms are putting into place an effective governance structure (Barari *et al.*, 2012; Gimenez *et al.*, 2012; and 17 others) and standardizing the methods and processes (Egels-Zandén *et al.*, 2015; Kerr and Foster, 2011; and 5 others).

4.6 Assessment practices

Based on a study by Sancha *et al.* (2016) on assessing specific supplier performance, the collaborative mechanisms in this block concern activities that enable collaboration for supply chain sustainability via evaluation and monitoring. However, selecting a particular partner because of its sustainably-oriented practices would rather be considered in the supply chain design mechanism category, as explained in the following subsection. Collaborative mechanisms in the AP category help firms evaluate their performance and the performance of their partners so that they can make adjustments when needed.

Collaborative mechanisms in the AP category were found in only 7% of the contributions in this SLR. The most frequently mentioned collaborative mechanism in this category is sustainability performance assessment (Fischer *et al.*, 2016; Kurdve *et al.*, 2015; and 17 others). For example, a particular sustainability initiative might require life-cycle assessment (Bonou *et al.*, 2016; Formentini and Taticchi, 2016; and 2 others) or maybe green supplier assessment (Li and Found, 2016; Siddiqui and Raza, 2015; Tesfay, 2014). According to the sustainable performance indicators that are required, monitoring procedures (Chopra and Wu, 2016; Blanco *et al.*, 2016; and 14 others) and auditing procedures (Akhavan and Beckmann, 2017; Maloni and Benton, 1997; and 3 others) are collaborative mechanisms that could be put in place. Environmental certification is also another collaborative mechanism that can be used either as performance expectations in a particular initiative or as selection criteria for potential sustainability initiative partnerships (Gallear *et al.*, 2015; Gavronski *et al.*, 2011; and 11 others). One of the benefits of performance assessment is that partners develop a mutual understanding of accountability for environmental performance (De Giovanni and Vinzi, 2012 and 2014; Tseng and Bui, 2017). The performance results can then be used to prioritize process optimizations (De Giovani and Vinzi, 2014; Pimenta and Ball, 2015; and 2 others). To this effect, a few contributions proposed optimization models for sustainability initiatives such as Soysal's (2016) closed-loop inventory routing optimization model that considers fuel consumption or Türkay *et al.*'s (2004) energy sharing optimization model.

4.7 Supply chain design

Sustainable supply chain design will take both environmental (gas emissions, waste reduction, etc.) and social (job creation, social repercussions, etc.) aspects into consideration when being established (e.g. choosing a building location, closing a factory, choosing a supplier, etc.). The collaborative mechanisms in this category will facilitate collaboration in supply chain sustainability initiatives by offering decision-making tools to supply chain partners. In turn, a supply chain designed by taking into account sustainability issues will offer a more collaborative environment for present and future sustainability initiatives.

The most frequently mentioned collaborative mechanism in this category is selecting sustainability-oriented partners (Amer and Eltawil, 2014; Goyal *et al.*, 2017; and 4 others) or more specifically sustainability-oriented suppliers (Aguiar *et al.*, 2013; Bonou *et al.*, 2016; and 16 others). For example, Govindan *et al.* (2013) proposed a model to measure the sustainability performance of a supplier based on economic, environmental, and social aspects to help with supplier selection operations. Tseng and Bui (2017) also mentioned that geographic proximity can be considered when choosing a supplier as it favors trust and collaboration while minimizing costs and impacts on material flow.

A few contributions addressed supply chain design directly, stating that supply chain design or facility location decisions should be taken in collaboration with other supply chain partners (Amer and Eltawil, 2014; Ding *et al.*, 2016a). Choosing a transportation mode could also consider sustainability issues (Siddiqui and Raza, 2015) or a firm could decide to partner with an eco-certified transportation provider (Ellram and Golicic, 2016).

Table 1 demonstrates the distribution of the studies regarding the proposed seven categories.

Collaborative mechanism category	Description	Examples of collaborative mechanisms	No. of studies
Relationship management	Activities that facilitate the management of relationships among stakeholders	Communication, raising awareness, meetings, networking, training, integration, motivation	150
Contractual and economic practices	Written or spoken agreement among stakeholders with or without incentives	Contracts, incentive alignments, rewards, cost-profit sharing	127
Joint practices	Common, bilateral, and mutual activities among stakeholders	Joint effort, joint planning, joint solution finding, collaborative decision-making, common goal, sharing resources	122
Technological and information sharing practices	Activities regarding the data and tools used in facilitating the procedure of collaboration among different entities of a supply chain	Information and knowledge sharing, information systems, platforms	113
Governance practices	Rules, trends, policies, and administrative laws to control, direct or manage the activities, organizations, and systems	Laws, policies, guidelines, regulations, performance standards, governance structure	105
Assessment practices	Activities that increase the quality of performance in supply chains via evaluation and monitoring	Performance assessment, life cycle assessment, supplier assessment, monitoring, audit, certification	54
Supply chain design	Considers an environmentally and social friendly structure for the supply chain	Supplier selection, facility location decisions	44

5. Discussion

The articles found in this research confirmed the key role collaboration may play in sustainability initiatives. One of the particularities of interfirm collaborations for sustainable supply chains is that they usually involve partners from outside the supply chain and many stakeholders, in a context where considering environmental and social aspects is usually less profitable in the short term (Albino *et al.*, 2012). According to many authors, addressing complex sustainability issues requires network-based collaboration based on a common goal and sustainability performance standards. Putting in place monitoring procedures and contracts to enforce these standards also seem to be of utmost importance for sustainability initiatives.

If we look at the mechanisms more specifically, among the 190 papers recognizing the role of collaboration in moving a current supply chain toward a more sustainable one, 187 papers addressed at least one collaborative mechanism. In fact, a detailed analysis of how many collaborative mechanism categories were addressed by each contribution demonstrated that the majority of contributions mentioned collaborative mechanisms from at least 4 categories. This seems to indicate that combining mechanisms from different categories would be more beneficial than targeting mechanisms from only one category. Figure 4 illustrates the percentage of contributions mentioning collaborative mechanisms from a given number of categories.

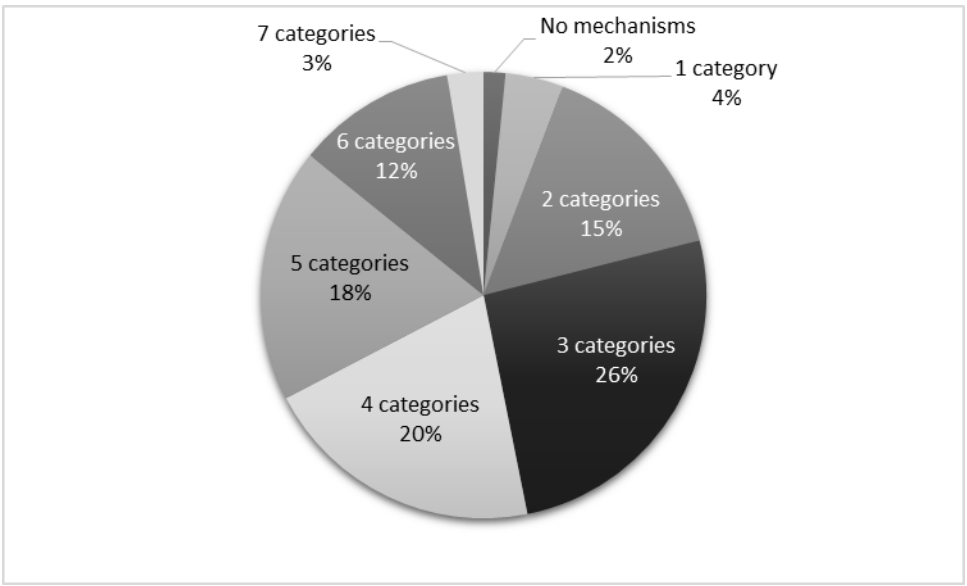

Fig. 4. Percentage of contributions mentioning collaborative mechanisms from a given number of categories

A good example is the work of Luzzini *et al.* (2015) in which the role of intra- and interfirm collaborative capabilities in the upstream supply chain was studied through a set of reflective indicators such as cross-functionality of decision making for supply market analysis (JP category), sourcing strategy (GP category), supplier selection (SCD category), contracting (CEP category), and supplier evaluation (AP category). Via a quantitative methodology and the analysis of data from 383 procurement executives of European and North American countries, they showed the links between sustainability commitment (RM category) and both intra- and interfirm collaborative capabilities as well as between interfirm collaborative capabilities and environmental, social, and cost performance.

The set of mechanisms that each contribution mentioned seemed to depend on the sustainability initiative's objective, the business environment complexity considered as well as the level of trust and effort stakeholders are willing to put forward. Tesfay (2014) for instance studied the strategy of sea transport outsourcing and in particular how an oil and gas company coordinates with such a strategy. Via the case study, they showed that the best solution regarding environmentally friendly sea transport service is to select certified suppliers, make partnerships, and provide contracts with cost refund agreements. Lind *et al.* (2016) addressed a much more complex sea transport sustainability initiative. They proposed an infrastructure that would allow standardized real-time information sharing between ships and ports to support the Sea Traffic Management (STM) sustainability initiative. STM aims to share relevant and timely maritime information between service providers so that they may be aware of maritime situations, improve predictability of arrivals and departures, plan just-in-time operations, and provide innovation capability. The collaborative mechanisms found in this article cover all 7 categories: providing situational awareness, benefit sharing, collaborative decision-making, information sharing, holistic sea traffic management approach, international maritime standards, continuously monitoring and adjusting voyage plan, traffic coordination, and port call synchronization/optimization.

While all the mechanisms found seem to play a role in improving supply chain sustainability, many authors have also pointed out non-negligible challenges to face, such as the lack of trust between supply chain members, the level of commitment and the lack of interest to share risks, the need for training and visibility, a high level of required bureaucracy, the presence of a traditional management philosophy, incompatible technology, project-based context of work (short-term tasks), and unfair benefit sharing (see for example Walker *et al.*, 2008 or O'Keefe *et al.*, 2016). As a result, even though the results highlighted in the literature show the positive impact collaboration may have on sustainability initiatives, businesses should still keep in mind these challenges when selecting and deploying their collaborative mechanisms.

6. Conclusion

In this research, a systematic literature review was conducted to identify the papers that addressed the role of collaboration in improving supply chain sustainability. Research questions and criteria were determined and a set of keywords and pre-defined search engines selected. Based on search results, an extensive number of papers were evaluated and 190 of them were identified as relevant according to the research questions. All accepted papers were analyzed and classified based on the year of publication, the country of origin of the first author and the methodology used. Among all selected papers, 187 of them addressed specific collaborative mechanisms. These mechanisms were classified into seven categories: relationship management, contracts and economic practices, joint practices, technology and information sharing practices, governance practices, assessment practices, and supply chain design.

Results from the systematic literature review confirmed that collaboration is useful to improve the sustainability of a supply chain, that it has been recognized as such by academics as by the industry, and that it may take multiple inter-organizational forms depending on the context considered. An analysis of the methodologies used in the contributions revealed that most of the authors used case studies. However, in recent years, we notice a definite increase in the number of contributions with qualitative, quantitative and mathematical or simulation modeling methodologies. Regarding the mechanisms, the top five most frequently mentioned, in decreasing order, are contracts, economic incentives, communication, information sharing, and integration. Another striking result is that 96%

of the contributions mentioned collaborative mechanisms from more than one category. This seems to indicate that combining mechanisms from different categories would be more beneficial than targeting mechanisms from only one category.

Results of this research may help future practitioners to recognize the effective collaborative mechanisms for improving their supply chain sustainability. They also highlight interesting challenges that could certainly be studied more deeply: the choice of the mechanisms to implement depending on the maturity level of each partner, the periods and the frequency to efficiently combine different mechanisms over time, the most appropriate mechanisms to select regarding the structure of the inter-organizational collaboration considered, the trade-off between the level of investment available and the complexity of the collaborative mechanisms implemented, the development of the right KPIs to track mechanisms from both an individual and a supply chain point of view, the investigation of case studies to evaluate the effectiveness of the proposed collaborative mechanisms, as well as an evaluation of the mechanism interconnections via statistical analysis.

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APPENDIX A

Table A1 presents the 190 papers that recognize the importance of collaboration in sustainable supply chains. For each, we state the methodology used, the industry targeted, and the categories corresponding to the collaborative mechanisms mentioned.

Legend

RM: Relationship management **CEP**: Contractual and economic practices **JP:** Joint Practices

TISP: Technological and information sharing practices **GP**: Governance practices

AP: Assessment practices **SCD**: Supply chain design

Table A1

Author	Methodology	Industry	Collaborative Mechanism Categories						
			RM	CEP	JP	TISP	GP	AP	SCD
Abbasi *et al.* (2016)	Quantitative	Automotive	x		x		x		
Acquaye *et al.* (2015)	Quantitative	Food				x	x	x	
Adams (2008)	Qualitative	Food					x		
Aguiar *et al.* (2013)	Qualitative	Diverse industries	x	x	x	x	x		x
Airike *et al.* (2016)	Qualitative	Electronic	x	x	x				
Akhavan and Beckmann (2017)	Qualitative	Diverse industries	x	x	x	x	x	x	x
Albino *et al.* (2012)	Quantitative	Diverse industries	x	x	x				
Amaro and Barbosa-Póvoa (2013)	Modelling	Forest products	x		x				
Amer and Eltawil (2014)	Struct. lit. rev.	N/A	x	x	x				x
Anthony and Ferroni (2012)	Case study	Food	x			x			
Aschemann-Witzel *et al.* (2017)	Case study	Food	x	x					
Bai *et al.* (2012)	Modelling	Energy		x	x				
Barari *et al.* (2012)	Modelling	Apparel	x	x		x	x		
Barnes and Mattsson (2016)	Quantitative	Diverse industries			x	x			
Basiri and Heydari (2017)	Modelling	Retail	x	x	x		x		
Bernstein and Cashore (2007)	Qualitative	N/A	x	x	x		x		
Bishop and Riopelle (2011)	Case study	Chemical	x					x	x
Bisogno (2016)	Qualitative	Food	x						x
Blanco *et al.* (2016)	Quantitative	Logistics						x	
Blome *et al.* (2014)	Quantitative	Diverse industries	x		x		x		
Bonou *et al.* (2016)	Quantitative	Energy						x	x
Boström *et al.* (2015)	Struct. lit. rev.	N/A	x	x		x	x	x	
Brockhaus *et al.* (2013)	Qualitative	Diverse industries	x	x	x				x
Brown *et al.* (2007)	Case study	N/A	x	x		x	x		
Bucklew (2011)	Qualitative	Logistics		x		x			x
Burlingame and Pineiro (2007)	Qualitative	Food			x				
Cao and Zhang (2013)	Modelling	N/A		x	x				
Cao *et al.* (2015)	Modelling	N/A	x	x			x		
Cao *et al.* (2017)	Case study	Apparel	x	x	x	x	x		
Chan *et al.* (2012)	Quantitative	Diverse industries		x	x	x	x		
Chenga (2011)	Quantitative	Construction	x			x			
Cheung *et al.* (2009)	Qualitative	Diverse industries	x	x	x	x	x		
Chin *et al.* (2015)	Qualitative	Manufacturing	x		x	x			
Chkanikova (2015)	Case study	Food	x	x	x		x		
Chopra and Wu (2016)	Quantitative	Electronic			x	x	x	x	
Dai *et al.* (2015)	Quantitative	Diverse industries	x	x	x	x			
Dale *et al.* (2016)	Qualitative	Energy	x	x	x	x	x		
Dan *et al.* (2010)	Quantitative	N/A	x	x	x			x	
Dangelico *et al.* (2013)	Quantitative	Forest products	x	x		x	x		x
Davidson *et al.* (2014)	Qualitative	Food	x	x					
De Giovanni and Vinzi (2012)	Quantitative	Diverse industries	x		x		x		
De Giovanni and Vinzi (2014)	Quantitative	Diverse industries	x	x	x	x		x	x
De Sousa Jabbour *et al.* (2015)	Quantitative	N/A	x		x			x	
De Souza *et al.* (2014)	Case study	Diverse industries	x	x		x			

Author	Methodology	Industry	Collaborative Mechanism Categories						
			RM	CEP	JP	TISP	GP	AP	SCD
Delmotte *et al.* (2016)	Modelling	Food	x		x	x			
Ding *et al.* (2015)	Modelling	Automotive		x	x		x		
Ding *et al.* (2016a)	Modelling	Automotive	x	x			x		x
Ding *et al.* (2016b)	Modelling	Automotive		x			x		x
Dissanayake and Sinha (2015)	Qualitative	Manufacturing	x		x			x	x
Egels-Zandén *et al.* (2015)	Case study	Apparel	x	x	x		x		
Ellram and Golicic (2016)	Case study	Logistics	x	x		x	x	x	
Fiorino and Bhan (2014)	Qualitative	Electronic	x	x	x	x	x	x	
Fischer *et al.* (2016)	Qualitative	Automotive	x		x	x		x	
Fischer and Pascucci (2017)	Case study	Apparel	x	x	x	x	x		x
Flint and Signori (2014)	Qualitative	Food	x		x	x			
Formentini and Taticchi (2016)	Case study	Diverse industries	x	x	x	x	x	x	
Forsman *et al.* (2014)	Qualitative	Food	x	x	x		x	x	x
Gallear *et al.* (2015)	Quantitative	Diverse industries	x	x	x	x	x	x	
Gavronski *et al.* (2011)	Quantitative	Manufacturing	x		x	x		x	x
Germani *et al.* (2015)	Case study	Manufacturing	x			x			x
Ghosh and Shah (2015)	Modelling	N/A	x	x	x				
Gimenez *et al.* (2012)	Quantitative	Diverse industries			x		x	x	
Gold *et al.* (2010)	Struct. lit. rev.	N/A	x	x	x	x	x		
Govindan *et al.* (2013)	Modelling	N/A	x		x				x
Goyal *et al.* (2017)	Case study	Diverse industries	x			x	x		x
Grekova *et al.* (2016)	Quantitative	Food	x	x	x	x			
Grimm *et al.* (2016)	Case study	Diverse industries	x	x	x	x		x	
Gunasekaran *et al.* (2015)	Struct. lit. rev.	N/A	x	x	x				
Hajdul (2014)	Modelling	Diverse industries			x	x			
Hall *et al.* (2013)	Qualitative	Logistics	x	x		x	x		
Halloran *et al.* (2014)	Case study	Food	x	x	x	x	x	x	
Hazelton *et al.* (2013)	Qualitative	Manufacturing	x	x		x	x		
Hisjam *et al.* (2015)	Modelling	Forest products		x					
Hsueh (2015)	Modelling	N/A	x	x		x	x		
Hu *et al.* (2015)	Modelling	N/A	x			x			
Huo *et al.* (2016)	Quantitative	Diverse industries	x	x					
Hussain *et al.* (2015)	Modelling	N/A	x	x	x	x	x	x	
Iacob (2015)	Qualitative	Forest products		x			x		
Jakhar (2015)	Modelling	Apparel	x	x	x		x		x
Jamnadass *et al.* (2014)	Case study	Food		x	x	x	x	x	
Jernström *et al.* (2017)	Quantitative	Forest products							
Jiang *et al.* (2016)	Qualitative	Oil and gas	x	x	x	x	x		x
Kerr and Foster (2011)	Qualitative	Food			x	x	x		
Klassen and Vachon (2003)	Quantitative	Manufacturing	x	x	x	x	x		
Klassen and Vereecke (2012)	Case study	Diverse industries	x	x	x	x	x	x	
Koh *et al.* (2012)	Case study	Information Tech.	x				x		
Korhonen *et al.* (2015)	Qualitative	Forest products	x		x			x	
Kovács (2008)	Case study	Diverse industries	x		x			x	
Kremer *et al.* (2016)	Modelling	Manufacturing							
Kulak *et al.* (2016)	Case study	Food	x	x	x				
Kumar and Malegeant (2006)	Case study	Apparel	x			x			
Kuo (2010)	Modelling	Electronic	x			x			
Kurdve *et al.* (2015)	Case study	Manufacturing	x	x	x	x	x	x	x
Laari *et al.* (2016)	Quantitative	Manufacturing	x	x	x	x	x	x	
Le Dû and de Corbière (2011)	Qualitative	Retailer sector				x	x		x
Leadbitter and Benguerel (2014)	Qualitative	Food	x	x	x		x	x	
Lee and Kim (2011)	Case study	Electronic	x	x	x		x		
Leitizia and Hendrikse (2016)	Modelling	Food	x	x					x
Li and Found (2016)	Qualitative	N/A	x	x	x	x	x	x	
Lim and Phillips (2008)	Case study	Apparel		x	x	x	x		

Author	Methodology	Industry	Collaborative Mechanism Categories						
			RM	CEP	JP	TISP	GP	AP	SCD
Lin (2013)	Modelling	Electronic	x	x	x				
Lind *et al.* (2016)	Qualitative	Logistics	x	x	x	x	x	x	x
Luo *et al.* (2015)	Quantitative	Manufacturing	x	x	x	x		x	
Luzzini *et al.* (2015)	Quantitative	Diverse industries	x	x		x	x	x	x
Mahony (2012)	Case study	Food	x				x		
Malik *et al.* (2016)	Case study	Healthcare	x	x	x	x	x		x
Maloni and Benton (1997)	Struct. lit. rev.	N/A	x	x	x	x		x	x
Matt *et al.* (2014)	Case study	Construction	x		x		x		
Mengistie *et al.* (2015)	Qualitative	Food		x	x	x	x		
Miller and Pollard (2005)	Case study	Food	x	x	x	x			
Mirhedayatian *et al.* (2014)	Modelling	Food							
Molina-Besch and Pålsson (2016)	Case study	Diverse industries	x	x			x		
Moreno-Peñaranda *et al.* (2015)	Case study	Oil and gas	x		x				
Morose *et al.* (2011)	Case study	Electronic				x			
Mourtzis *et al.* (2012)	Modelling	Automotive				x	x		x
Muller *et al.* (2012)	Case study	Food	x	x	x		x		
Musa *et al.* (2014)	Struct. lit. rev.	N/A	x	x	x	x			
Nakano and Hirao (2011)	Case study	Diverse industries	x	x		x			
Nathanail *et al.* (2016)	Quantitative	Logistics	x	x	x	x	x	x	x
Nematollahi *et al.* (2017a)	Modelling	Pharmaceutical			x			x	
Nematollahi *et al.* (2017b)	Modelling	N/A		x	x			x	
Newsome *et al.* (2014)	Qualitative	Food	x			x	x		
Newton *et al.* (2013)	Struct. lit. rev.	Food		x		x	x		
Niesten *et al.* (2017)	Qualitative	N/A	x				x		
Nwaka (2005)	Case study	Pharmaceutical	x	x	x				
Oelze *et al.* (2014)	Qualitative	Diverse industries	x	x	x	x			
O'Keeffe *et al.* (2016)	Case study	Construction	x	x		x	x	x	
Pant *et al.* (2015)	Case study	Food	x	x	x	x	x		
Patala *et al.* (2014)	Struct. lit. rev.	N/A	x	x	x	x	x		
Pehlken *et al.* (2016)	Qualitative	Energy	x	x					x
Perdikakis *et al.* (2015)	Case study	N/A	x			x	x		
Persson and Werner (2012)	Quantitative	Energy	x	x	x				
Pimenta and Ball (2015)	Struct. lit. rev.	N/A	x		x	x	x	x	
Ramanathan *et al.* (2014)	Case study	Diverse industries	x	x	x	x			
Reefke and Sundaram (2017)	Qualitative	Diverse industries	x	x	x	x	x	x	x
Réviron and Chappuis (2005)	Case study	Food	x	x	x		x	x	
Richter and Bokelmann (2016)	Quantitative	Food	x	x		x			
Rizzi *et al.* (2013)	Struct. lit. rev.	N/A	x	x	x	x	x		
Rodger and George (2017)	Modelling	Energy		x		x	x		
Rodríguez *et al.* (2016)	Case study	Diverse industries	x	x	x	x	x		x
Roldán *et al.* (2014)	Modelling	Logistics	x	x		x			
Ross and Jayaraman (2009)	Modelling	Healthcare		x					x
Roy and Whelan (1992)	Case study	Electronic	x	x	x	x	x		
Sahamie *et al.* (2013)	Struct. lit. rev.	Diverse industries	x	x	x	x			
Sancha *et al.* (2016)	Quantitative	Diverse industries	x		x			x	
Sari (2010)	Modelling	N/A	x		x	x			
Schenkel *et al.* (2015)	Struct. lit. rev.	N/A	x	x	x	x	x		
Schniederjans and Hales (2016)	Quantitative	Information Tech.				x			
Secondi *et al.* (2015)	Quantitative	Food	x	x		x			
Seuring and Gold (2013)	Qualitative	N/A	x		x		x	x	x
Shanoyan *et al.* (2014)	Quantitative	Food		x			x		
Siddiqui and Raza (2015)	Struct. lit. rev.	N/A	x		x	x	x	x	x
Sigala (2008)	Case study	Tourism		x	x	x	x	x	x
Sime (2005)	Qualitative	Healthcare	x	x	x		x		
Singh *et al.* (2016)	Case study	Automotive	x	x	x	x		x	
Sippl (2015)	Qualitative	Mining	x	x	x	x	x		

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Smith *et al.* (2016)	Qualitative	Energy	x	x		x	x		x
Solakivi *et al.* (2013)	Quantitative	Diverse industries	x		x				
Solér *et al*. (2010)	Case study	Food	x	x	x	x	x		
Soysal (2016)	Modelling	Food						x	
Steele and Feyerherm (2014)	Case study	Food		x	x	x			x
Styles *et al.* (2012)	Quantitative	Retailer sector	x				x		x
Tarandi (2015)	Qualitative	Construction	x	x		x	x		
Teixeira *et al.* (2016)	Quantitative	Manufacturing	x		x		x		
Tesfay (2014)	Case study	Oil and gas	x	x		x	x	x	x
Theiβen *et al.* (2015)	Case study	Manufacturing	x	x	x	x	x		
Touboulic and Walker (2015)	Qualitative	Food	x	x	x	x	x	x	
Tseng and Bui (2017)	Quantitative	Apparel			x	x	x	x	x
Tsoi (2010)	Case study	Apparel	x	x	x		x		
Türkay *et al*. (2004)	Modelling	Energy			x			x	
Umar *et al.* (2013)	Case study	Oil and gas		x					
Vachon and Klassen (2006)	Quantitative	Package printing	x	x	x				
Vachon and Klassen (2008)	Quantitative	Manufacturing	x		x				
Van Hoof and Lyon (2013)	Quantitative	Manufacturing	x	x		x			
Van Hoof and Thiell (2014)	Quantitative	Diverse industries	x	x	x	x			
Vrijhoef *et al.* (2014)	Qualitative	Construction	x	x	x	x	x		x
Vurro *et al.* (2009)	Qualitative	N/A	x	x	x		x		
Waller *et al.* (2015)	Qualitative	N/A				x		x	
Wan Ahmad *et al.* (2016)	Qualitative	Energy	x		x	x	x	x	x
Wang *et al.* (2011)	Case study	Logistics	x	x		x	x		
Wang *et al.* (2016)	Qualitative	N/A	x			x	x	x	
Wiengarten and Longoni (2015)	Quantitative	Manufacturing	x	x	x	x	x		
Woo *et al.* (2016)	Quantitative	Construction	x	x	x	x			
Xing *et al.* (2016)	Qualitative	Apparel				x		x	
Yan *et al.* (2016)	Quantitative	Electronic	x	x	x		x	x	
Yenipazarli (2017)	Modelling	N/A	x	x	x				
Youn *et al.* (2013)	Quantitative	Manufacturing	x	x		x			
Ytterhus *et al.* (1999)	Qualitative	Food	x	x	x	x	x		
Zander *et al.* (2016)	Case study	Forest products	x	x	x	x	x		
Zsidisin and Siferd (2001)	Struct. lit. rev.	N/A	x	x	x	x	x	x	