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Circular supply chain governance: A qualitative-empirical study of the European polyurethane industry to facilitate functional circular supply chain management

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ABSTRACT

For many industries, the transition towards a circular economy (CE) is rather challenging because firms need to collaborate with actors within and beyond immediate industry boundaries. Scholars and practitioners expect synergies for circular supply chain management (CSCM) by understanding the role of governance both from a CE perspective and a sustainable supply chain management (SSCM) perspective. However, a systematic analysis of governance mechanisms in their vertical and particularly horizontal (re-)direction is still absent in the extant literature. In response, this study delivers a qualitative-empirical analysis of governance mechanisms' directions based on evidence from the European polyurethane industry. Major findings indicate that whereas governance mechanisms for vertical collaboration—mostly discussed in SSCM—are of limited value to facilitate functional CSCM, governance mechanisms for horizontal collaboration can promote the closing of resource loops. In addition, we find three strategic prerequisites for organizations that facilitate horizontal relationships: (1) the development of a CE-enabling environment, (2) the innovation of a circular business model, and (3) the formation of strategic alliances with specialized partners within and outside the industry. If the proposed governance mechanisms for horizontal collaboration can be system(at)ically integrated into supply chain management practices, managers may be better equipped to organize collaboration for functional circular supply chains.

1. Introduction

Until recently, the research fields of circular economy (CE) and sustainable (including green) supply chain management (SSCM)[1] have represented separate disciplines. But there exists an evolving enthusiasm and a growing research interest in incorporating CE into (S)SCM (e.g., Aminoff and Kettunen, 2016; Batista et al., 2018; Bressanelli et al., 2019; De Angelis et al., 2018; Farooque et al., 2019; Govindan and Hasanagic, 2018; Howard et al., 2019; Kazancoglu et al., 2018; Lahane et al., 2020). Researchers expect that understanding the synergies between both concepts potentially can promote sustainability (Genovese et al., 2017; Nasir et al., 2017).

Scholarship emergingly applies a governance perspective on SSCM (e.g., Formentini and Taticchi, 2016; Govindan et al., 2016; Panigrahi et al., 2019; Tachizawa and Wong, 2015; Yang and Lien, 2018) and CE (e.g., Fischer and Pascucci, 2017; Ghisellini et al., 2016; Hansen and Revellio, 2020; Korhonen et al., 2018a,b), which can support the analysis of governance mechanisms[2] facilitating the management of

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[1] In supply chain management (SCM) literature on sustainability, SSCM and green supply chain management (GSCM) have been used interchangeably (Gurtu et al., 2015). Whereas we generally appreciate a differentiation between these concepts, we subsume GSCM research under the umbrella concept of SSCM concerning the research objective of governance in this study and follow the argument by Ahi and Searcy (2013, p. 334) that "SSCM is essentially an extension of GSCM."

[2] This study provides a holistic lens on governance mechanisms' directions and, therefore, excludes the formalization aspect—formal and/or informal (e.g., Alvarez et al., 2010; Pilbeam et al., 2012; Yang and Lien, 2018) since this exceeds the scope of this study but provides an interesting future research avenue.

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inter-organizational collaboration to pave the way for sustainability and circularity, respectively. However, the governance challenges for managing collaboration differ between SSCM and CE. While the SSCM literature using a governance perspective (cf. Panigrahi et al., 2019; Vermeulen and Seuring, 2009) extensively discusses the management of vertical collaboration[3] (Chen et al., 2017) with upstream and downstream partners or third parties' collaboration (NGOs, universities, etc.) (Koberg and Longoni, 2019), the CE literature identifies challenges beyond vertical approaches and emphasizes the need for horizontal collaboration with competitors and further actors within and outside the industry (cf. Fischer and Pascucci, 2017; Korhonen et al., 2018a,b). This raises the question whether—and to what extent—the findings of the SSCM governance literature can be applied to the CE at all and to circular supply chain management (CSCM) in particular since scholars recently acknowledged governance as one key theory to investigate CSCM practices for achieving sustainable competitive advantage (Lahane et al., 2020).

To bridge the gap in knowledge, we use the ordonomic approach (Pies et al., 2009, 2010, 2014, 2020; Pies, 2016) to apply a theoretical governance perspective on both literature streams and thus to identify the governance challenges for CSCM. This ordonomic approach supports the analysis of SSCM governance mechanisms for collaboration to improve supply chain sustainability (e.g., Formentini and Taticchi, 2016). Furthermore, it supports the CE literature that discusses governance mechanisms which are required for enabling (novel) forms of collaboration to facilitate system re-design (e.g., Fischer and Pascucci, 2017; Korhonen et al., 2018 a,b). Instead of eclectically mingling both literature streams, we strengthen the theoretical foundation for governance mechanisms addressing the urgent call on investigating inter-organizational collaboration for CSCM (e.g., Farooque et al., 2019) and also provide information for a real-world context as explicitly demanded by De Angelis et al. (2018). Therefore, we conduct qualitative-empirical research (Ariño et al., 2016) by studying the European polyurethane (PUR) industry. We have chosen this sector because petrochemical and plastic supply chains are causing one of the most pressing environmental issues of our time (UN Environment Programme, 2018) and simultaneously possess a huge (yet unrealized) potential for a CE transition (Brice, 2019). We conducted semi-structured interviews with 22 PUR industry experts, obtaining 1209 min in audio-recording time. We apply an abductive research method combining inductive category development with deductive consideration of existing theories (Gioia et al., 2013).

Major findings indicate that, first, governance mechanisms for vertical collaboration rather follow an "optimization logic" to improve focal firms'[4] individual supply chain sustainability with upstream (and/or downstream) partners. In particular, our study indicates that such a vertical approach is of limited value and only suitable for niche markets or large well-known brands with huge asymmetric market power. Second, we find horizontal mechanisms for collective commitment—Push, Pull (intra-industrial)—as well as functional and promising horizontal mechanisms to provide services for collective commitment—Pull (inter-industrial), Pull (inter-sectoral)—that can pave the way for closed- and open-loop supply chains by overcoming free-rider issues. In addition, we find three strategic deliberations for supply chain managers to establish such viable Pull mechanisms, including (i) developing a CE-enabling environment that is able to encourage inter-industrial and -sectoral collaboration, (ii) focusing on innovating circular business models to enable operations in inter-industrial and -sectoral loops, and (iii) building strategic alliances with specialized partners within and beyond immediate industry boundaries to realize small group transaction cost advantages (e.g., Williamson, 1991, 1996, 1998) and thus helps to efficiently orchestrate CE-oriented supply networks. We posit that if governance mechanisms for horizontal collaboration get to the roots of CSCM, managers will be in a better position to systematically integrate the CE philosophy into supply chain management practices.

2. Literature review

The literature streams on SSCM and CE share a common research interest in governance. Scholars using a governance perspective on sustainable supply chains (e.g., Gereffi et al., 2005; Tachizawa and Wong, 2015; Yang and Lien, 2018) or on CE (e.g., Fischer and Pascucci, 2017; Hansen and Revellio, 2020) commonly rely on Oliver Williamson's understanding of governance, i.e., as "the means by which to infuse *order*, thereby to mitigate *conflict* and realize *mutual gain*" (Williamson, 2010; p. 674, emphasis in original). Scholars in SSCM (e.g., Formentini and Taticchi, 2016) and CE (e.g., Fischer and Pascucci, 2017) have realized that such a governance perspective is beneficial to analyze governance mechanisms for the management of inter-organizational collaboration. However, the literature streams on SSCM and CE tend to identify different governance challenges to organize functional collaboration schemes. While the SSCM literature mostly discusses governance of vertical collaboration, the literature on CE (and CSCM) emphasizes governance of horizontal collaboration.

2.1. The governance of vertical collaboration in sustainable supply chain management

Carter and Rogers (2008, p. 368) define SSCM as "strategic, transparent integration and achievement of an organization's social, environmental, and economic goals in the systemic coordination of key inter-organizational business processes for improving the long-term economic performance of the individual company and its supply chains." Against this background, the SSCM literature develops a governance perspective to investigate collaboration among companies along the supply chain (Panigrahi et al., 2019). SSCM research uses this governance perspective (cf. Govindan et al., 2016; Vermeulen and Seuring, 2009) to discuss the role of collaboration towards sustainable supply chains (e.g., Vurro et al., 2009) and analyzes sustainable supply chain governance mechanisms that focal firms can use to manage sustainability within their supply chains (e.g., Formentini and Taticchi, 2016; Koberg and Longoni, 2019; Sancha et al., 2016; Tachizawa and Wong, 2015; Yang and Lien, 2018). These mechanisms describe initiatives, practices, and processes to manage relationships with i) internal functions and ii) with external supply chain members and stakeholders (Formentini and Taticchi, 2016). For the latter, the literature discusses the factor of collaboration (e.g., Formentini and Taticchi, 2016; Panigrahi et al., 2019). Collaboration is one avenue for firms to form strategic alliances, share information, and/or reduce costs to improve performance and thus to realize a competitive advantage (Soylu et al., 2006).

The SSCM literature mostly focuses on the management of vertical collaboration (Chen et al., 2017) with upstream suppliers (e.g., Brockhaus et al., 2013; Gimenez and Sierra, 2013; Gimenez and Tachizawa, 2012; Tachizawa and Wong, 2015; Yang and Lien, 2018) or downstream customers (e.g., Lai et al., 2014; Zhang et al., 2015; Zhu et al., 2017). Studies found that collaborative and shared governance approaches in a vertical dimension represent functional instruments to manage sustainability initiatives successfully (e.g., Vurro et al., 2009; Gimenez and Sierra, 2013). Whereas vertical collaboration is extensively discussed in extant SSCM literature, "horizontal collaboration with competitors and

[3] Although large parts of supply chain literature interchangeably use the terminology horizontal collaboration to describe collaboration with third parties (NGOs, universities, consultancies, government, etc.) and collaboration with competitors (e.g., Boström et al., 2015; Chen et al., 2017), we propose to distinguish between horizontal collaboration with competitors (incl. competing supply chains) and (outside the supply chain) collaboration with third parties to emphasize the (novel) governance challenges arising for a CE.

[4] The term "focal firm" (Chen and Paulraj, 2004) and "leading firm" (Gereffi, 1999) is interchangeably used in supply chain literature.

others [e.g., NGOs] … were rarely studied" (Chen et al., 2017, p. 77). Recently, sustainable supply chain governance literature on third party collaboration (NGOs, universities, etc.) is emerging in the research on SSCM (Koberg and Longoni, 2019) but horizontal collaboration with competitors remains mostly neglected.

2.2. The governance of horizontal (and vertical) collaboration for a circular economy

Scholars argue that SSCM leads to an incremental shift towards 'weak sustainability' since it solely emphasizes resource efficiency (cf. Hussain and Malik, 2020). In contrast, the CE needs to be understood as a radical shift towards 'strong sustainability' by slowing (repair, reuse, remanufacture) and closing (recycling, recovery) resource loops with the aim to preserve products, components, and materials at their highest value and utility (e.g., Bocken et al., 2017; Hansen and Revellio, 2020; Hussain and Malik, 2020; Kirchherr et al., 2017). This radical shift faces "challenges in the governance and management of … inter-organizational and inter-sectoral material and energy flows." (Korhonen et al., 2018a, p. 45). However, such a governance perspective on CE is still at a nascent stage (cf. Ghisellini et al., 2016; Korhonen et al., 2018a,b) and, therefore, it is not surprising that studies aiming to connect (S)SCM and the CE perspective (e.g., De Oliveira et al., 2019; Kazancoglu et al., 2018) still focus on vertical and third party relations and thus in turn neglect a crucial part of the core-idea from the CE philosophy.

Whereas studies applying the governance view on SSCM have revealed that mechanisms for vertical collaboration are potentially able to improve sustainability in (linear) supply chains (Gimenez and Sierra, 2013), the CE philosophy requires close collaboration with multiple partners within and outside the industry and sector. This introduces novel challenges to supply chain management in order to vertically collaborate with suppliers and customers but also to horizontally collaborate with competitors and to partner with further actors (e.g., NGOs, universities, consultancies, governments, etc.) (De Angelis et al., 2018; Farooque et al., 2019).

Hence, (novel) governance mechanisms are required for a CE to enable actors changing formal and informal rules to shape inter-organizational collaboration schemes (Fischer and Pascucci, 2017), which demands the analysis of incentive structures (cf. Genovese et al., 2017) since "the main challenge faced by firms engaged in CE transition is to arrange collaboration and business relations, whilst being constrained by an institutional system that is aligned with the principles of linear economy" (Fischer and Pascucci, 2017, p. 19).

This finding has been corroborated in the CSCM literature, i.e., by Farooque et al. (2019, p. 895) who describe the need for future research on collaboration as "very high", the knowledge gap as "large", the potential impacts as "critical", and the priority as "very urgent". In particular, literature is calling for information on the practical side of how to introduce and manage circular supply chains in a real-world context (De Angelis et al., 2018).

2.3. The ordonomic governance perspective

For a systematic analysis of governance mechanisms for vertical and horizontal collaboration, an ordonomic governance perspective (Pies et al., 2009, 2010, 2014, 2020, 2010, 2020; Pies, 2016) can reveal synergies (and dissonances) between (S)SCM and CE literature streams and thus helps managing the governance challenges arising for a CE in general and CSCM in particular. The ordonomic approach has proven useful in investigating governance in corporate sustainability and corporate social responsibility research (cf. Beckmann et al., 2014; Pies et al., 2009, 2014, 2020). To systematically analyze governance, ordonomics proposes to use game theoretical tools—i.e., one-sided and many-sided social dilemmas (while the former describes an asymmetric situation where one actor can exploit another, the latter is a symmetric situation where all actors can exploit each other)—to reconstruct incentive structures that can lead to conflicts. Furthermore, in line with Oliver Williamson (1983), ordonomics suggests using credible commitments to mitigate conflicts and overcome social dilemma situations realizing mutual gains (Pies et al., 2009). By doing so, Pies et al. (2009) develop a conceptual framework to analyze credible commitments distinguishing between the two types of the "dilemma structure" and types of the "commitment technology" spanning a 2 × 2 matrix (Fig. 1):

- To overcome a one-sided dilemma, a focal firm can use an individual self-commitment (ISC) to specific stakeholders not to exploit them. A typical example is a product warranty in a producer-buyer relationship.
  - oTo help a partner to overcome a one-sided dilemma, a focal firm can offer a service for an individual commitment (SIC) to its partner. A typical example is a focal firm that helps its supplier with certified quality management.
  - oTo overcome a many-sided dilemma, competing firms can use a collective self-commitment (CSC) to promote "co-opetition" (Nalebuff and Brandenburger, 1996). A typical example is a voluntary industry standard.
  - oTo help a sub-group of actors in its supply network to overcome a many-sided dilemma, a focal firm can offer a service for a collective commitment (SCC). A typical example is a focal firm that helps upstream partners dealing with their coordination issue by organizing an association.

Using this ordonomic perspective, we can reformulate the vertical challenges that have mostly been studied in extant SSCM research as managing ISCs and SICs since these studies primarily investigate partnerships between a focal firm and its suppliers or sub-suppliers to improve sustainability performance along the supply chain. In addition, SSCM literature emergingly investigates the influence of third parties, that can also provide SICs to supply chain members.

We also can reformulate the horizontal challenges that have been highlighted in available CE and CSCM literature as drawing attention beyond ISCs and SICs towards CSCs to highlight horizontal collaboration between competitors ("co-opetition") and competing supply chains (cf. De Angelis et al., 2018). Although these growing research streams emphasize (novel) forms of collaboration and business relations, they remain silent on their design and implementation. This research gap is symbolically represented by the question mark in box (I) in Fig. 1.

Concludingly, both literature streams—SSCM and CE—can offer insights into functional governance mechanisms used by focal firms to facilitate sustainability and circularity, respectively. Using the ordonomic governance perspective, we have identified a promising research avenue with respect to SCCs. We bridge this gap by providing empirical evidence and developing theory towards functional governance mechanisms to enable collaboration for circular supply chains. By doing so, we draw on the focal firms' view from SSCM literature to organize services for commitments and the horizontal collaboration aspect initially highlighted in CE and CSCM literature.

3. Context of the study: The European polyurethane industry

We identified the European PUR industry and supply chains as a suitable research object for three reasons.

First, large parts of the global PUR industry are located in Europe. In the European Union (EU), PUR is one of the most used polymers with more than 4 million tons of consumption every year (PlasticsEurope, 2020). A vast majority of end-of-life materials still goes to landfill (approximately 460 kilotons/year) or incineration (Brice, 2019; European Commission, 2019). However, this sector has an enormous circularity potential (Brice, 2019). To unleash this (yet unrealized) CE aptitude, particularly the development of well-functioning circular (PUR) supply chains is a prerequisite (cf. Brice, 2019).

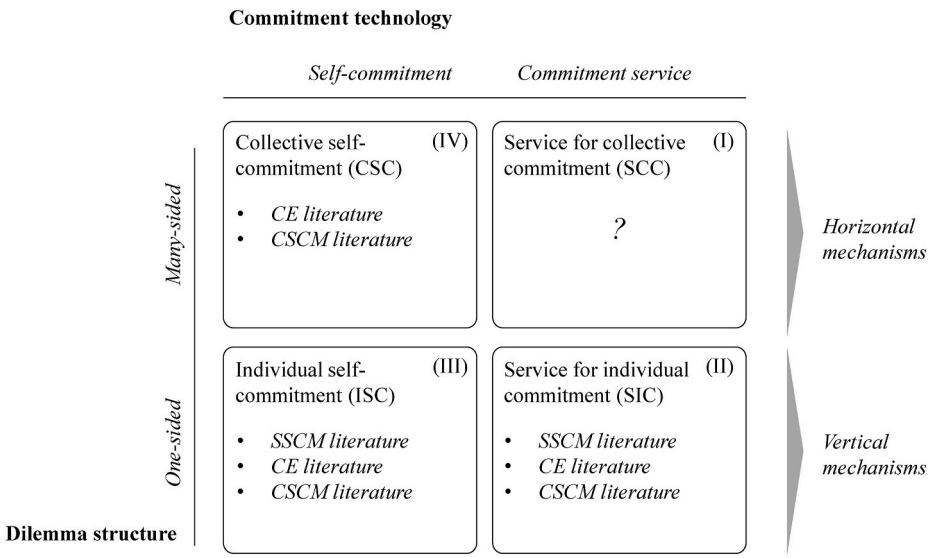

Fig. 1. Conceptual framework of commitments (adapted from Pies et al., 2009).

Second, PUR, a common thermoset polymer, is a versatile material that flows into various markets and end-applications (Akindoyo et al., 2016). Hence, PUR goes in a very broad series of supply chains, e.g., automotive, building & construction, mattresses & furniture, electrical & electronic, packaging, etc. (PlasticsEurope, 2020; Simón et al., 2018). Concludingly, this industry-setting provides a huge potential for a qualitative research approach on CE. Although PUR is very specific in its material properties, the similar structures between the PUR industry to other plastic industries (e.g., polyethylene-terephthalate (PET), polyethylene (PE), polypropylene (PP), etc.) will allow a transfer of our findings to most other of those industries.

Third, just recently, the PUR industry faces a trend towards the CE transition. Major Raw Material Producers have launched individual CE projects that aim to foster closed-loop concepts.[5] In addition, large End-Application Producers & Retailers like IKEA, a central player in mattress and furniture markets, have announced to become more circular in the next years (IKEA/INGKA, 2021). While we observe a first movement in the industry, the CE ambitions are mainly determined by individual efforts of single companies.

Although literature proposes a 3-R (Murray et al., 2017) or even a 9-R (Potting et al., 2017) approach of value retentions to a CE, our interviews revealed that slowing strategies by extending lifespan via repair, reuse, or remanufacture are of limited value to properly solve the waste issue for PURs (e.g., used mattresses are contaminated at the end-of-life). In our specific industry-context, chemical PUR recycling as a closing strategy provides the most promising avenue towards circularity (Brice, 2019; Simón et al., 2018). Innovation in chemical PUR recycling offers win-win potentials to reduce the environmental footprint by simultaneously improving the mechanical properties of materials (Ugarte et al., 2018) and potentially opening loops beyond immediate industry boundaries (cf. Larrain et al., 2020).

We conducted a small pre-study in which we interviewed three experts to understand the current (i) linear PUR supply chain and (ii) inter-organizational collaboration structures.

(i) Fig. 2 illustrates the nine different levels of a linear PUR value chain. According to our interviewees, (1) Oil & Gas companies deliver crude oil to (2) Raw Material Producers (large, asset-heavy, chemical companies) that refine and produce basic chemicals for PUR production (three basic components: diisocyanates, polyols, and additives) (cf. Akindoyo et al., 2016). (3) System Houses, which are either large chemical companies (vertically integrated system houses) or external system houses, convert diisocyanates, polyols, and additives into raw PURs for foams (e.g., mattresses, car seat cushions, etc.) or rigids (e.g., furniture, building insulation, etc.). (4) Distributors deliver the raw PUR to (5) PUR-Manufacturers, which produce semi-finished and finished goods. (6) End-Application Producers & Retailers as focal firms (F) assembly the products and sell them to (7) End-Users (consumers). Waste collectors pick up the material disposed by the End-Users and send the "waste" to (8) Waste Management for (mostly mechanical) recycling. Residuals are then either incinerated or landfilled (9).

(ii) The experts reported that in the current linear supply chain, mainly bi-lateral contracts (and agreements) between two directly related supply chain actors on a vertical basis exist. Accordingly, information flows are also bi-laterally restricted and mainly one-way. Concerning horizontal market relations, individual companies in the PUR industry face strong competition without (or only limited) collaboration between competitors.

4. Methods

Our research design is qualitative in nature (Ariño et al., 2016), which echoes the novelty of the emerging governance field and the scarcity of available empirical research for the CE (cf. Murray et al., 2017; Kirchherr and van Santen, 2019). We apply a three-step procedure consisting of data sampling (4.1), data collection (4.2), and data analysis (4.3).

4.1. Data sampling

We selected suitable interview partners to ensure academic rigor and practice-oriented insights. To do so, we applied two different selection mechanisms since participants from different supply chain levels may face distinct market structures. For supply chain levels with an oligopoly structure (e.g., Raw Material Producers), there was a natural selection due to the limited number of players operating in this market. In supply chain levels with a polypoly structure, we selected the interview partners by a randomized snowballing technique (e.g., Handcock and Gile, 2011; Miles et al., 2013), which was based on an initial request to official

[5] Examples are Covestro PUReSmart initiative for mattresses (Covestro, 2021), BASF ChemCycling initiative (BASF, 2021), or DOW Renuva program for mattresses (DOW, 2021).

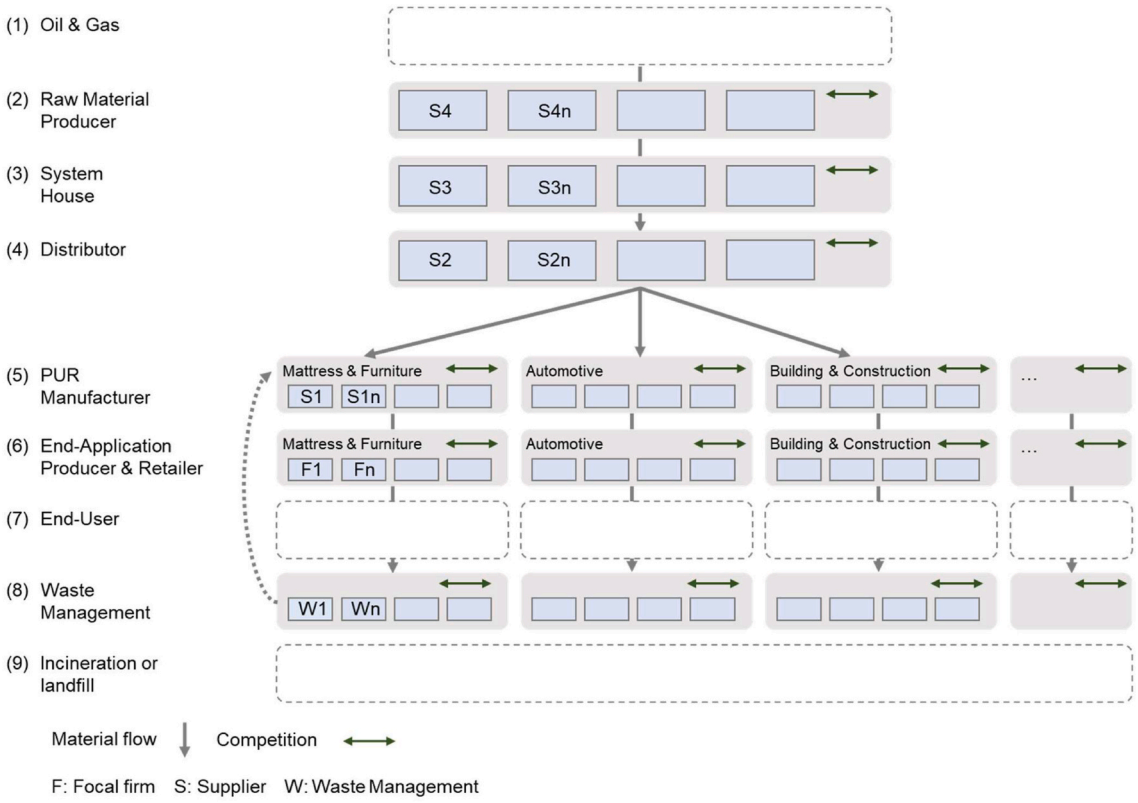

Fig. 2. (Linear) PUR supply chain structures.

members of PUR trade associations (e.g., Europur, Euro-Moulders, European Isocyanate Producers Association, FSK e.V., etc.). As a result, we were able to attract representative and major PUR organizations covering the entire supply chain. As shown in Table 1, we secured 22 experts for interviews, beginning from Raw Material Producers and System Houses, Distributers, PUR-Manufacturers, End-Application Producers & Retailers, and Waste Management Companies. In addition, we were able to interview PUR trade associations, a PUR research institute, and chemical supply chain experts. Accordingly, we can distinguish two categorial levels of experts: (a) experts on the directors and (senior) management level in firms (~60 %), and (b) subject matter and PUR industry experts (~40 %). Most of the experts possess a profound professional experience between 10 up to almost 40 years. Hence, this study consists of a medium N-sample design ($10 < N < 100$) and thus acknowledges the criticism by Kirchherr and van Santen (2019) that available CE literature is particularly lacking medium and large N-sample research.

4.2. Data collection

We conducted semi-structured interviews with 22 experts lasting between 45 and 85 min, which were held in English or German (translated into English) via telephone, WebEx online-conference, or in person. We obtained 1209 min of audio-recording time in total. The interview memos were transcribed and sent back to the interviewees for validation and clarification. To prevent possible biases in the interview process, we already considered limitations in the initial research setting. For their mitigation, the interview transcripts were triangulated with secondary sources such as company reports and public information (Voss et al., 2002). Anonymity was ensured during the interviews to gain additional insights and also allow for unconventional views and opinions (e.g., Berry, 2002; Gioia et al., 2013). We conducted the interviews from November 2019 to June 2020. In addition, validation meetings between researchers and PUR industry experts were organized to guarantee accurate, rigorous, theoretically well-founded, and practice-oriented results. Our applied triangulation and iterative research approach aimed at superior research outcomes and indeed led to a reduction of biases.

4.3. Data analysis

This study is based on an abductive research approach that combines (i) inductive category development with (ii) deductive consideration of existing theory (Gioia et al., 2013).

(i) Following the recommendations by Gioia et al. (2013), we initiated our data analysis through an inductive category development for qualitative content analysis (Mayring, 2000, Mayring, 2014). Our interview transcripts were manually analyzed and evaluated based on a dynamic and iterative six-step approach for inductive category development (Fig. 3). First, we formulated an initial research question concerning available studies on SSCM governance, CE governance, and CSCM. After conducting the interviews, we worked through the interview transcripts to identify and determine inductive category definitions. Third, based on an iterative procedure, we analyzed step-by-step the inductive categories and emerging codes from the transcripts. Fourth, we revised the categories and codes after analyzing 50 % of the material in several in-person validation meetings. Fifth, we finally worked through the materials and conducted a summative check of reliability. Finally, we interpreted our results and conducted further validation meetings. During the entire procedure, feedback loops after each process step were included as a quality gate. This was supported by various meetings with top-management consultants working in the chemical industry who took the role of "devil's advocates" with the task to challenge the interim results, ask critical questions, and hint at reconsidering specific data (e.g., Crosina and Pratt, 2019; Strike and

Table 1
Overview interviewees.

Value Chain Level	No.	Position	Prof. Experience	Recording Time
Raw Material Producer	1	Senior Manager – CE	35 years	74 min[1]
	2	Senior Manager – Sustainability	25 years	74 min[1]
	3	Vice President – R&D Additives	2 years	54 min
	4	Manager – Technical Service	7 years	75 min
	5	(Former) Senior Manager – R&D	38 years	85 min
Distributor	6	Senior Manager – PUR Elastomers	10 years	60 min
PUR-Manufacturer	7	Director – CEO	25 years	58 min
	8	Director – Marketing	25 years	60 min
Waste Collector & Recycler	9	Director – CEO	30 years	55 min
	10	Director – CEO	20 years	59 min
	11	Manager – Chemical Recycling	3 years	65 min
End-Application Producer & Retailer	12	Senior Manager – Sustainability	20 years	58 min[2]
	13	Manager – PUR Technology	16 years	58 min[2]
Trade Association	14	Secretary General	20 years	74 min[1]
	15	Secretary General	16 years	76 min
	16	Secretary General	4 years	62 min
Research Institute	17	Senior Manager – PUR Technology	22 years	83 min
Consulting	18	Partner & Managing Director	25 years	48 min
	19	Partner & Managing Director	25 years	47 min
	20	Director – CEO*	30 years	73 min
	21	Director – CEO*	25 years	72 min
	22	Senior Manager – Chemicals	14 years	45 min
				Total: 1209 min

* Former Senior Manager at Raw Material Producer.
1; 2 Within one interview session.

Rerup, 2016), which enabled us to understand the extremely complex and interwoven relationships between supply chain actors, the involved incentivization structures, and information flows within this versatile industry. This procedure enabled us to refine and validate our findings during the analysis process.

(ii) We conducted an iterative empirical-theoretical analysis by cycling between the inductive categories we had found and existing theories (cf. Gioia et al., 2013). Therefore, we applied the ordonomic governance perspective on our inductive categories by considering "co-evolutionary" development between inductive categories and the conceptual framework on commitments (Pies et al., 2009) to understand governance mechanisms for CSCM.

5. Findings

While our data indicate that (5.1) governance mechanisms for vertical collaboration—ISCs and SICs—are of limited value for addressing inter-industrial and -sectoral collaboration for a CE, we find evidence that (5.2) mechanisms for horizontal collaboration—CSCs and SCCs—allow focal firms to address incentivization for a CE more effectively. Our data reveal two supply chain levels in the PUR industry—Raw Material Producer and End-Application Producer & Retailer—that are eligible to introduce governance mechanisms to facilitate collaboration with partners, but they face different challenges.

5.1. Governance mechanisms for vertical collaboration

We find that governance mechanisms for vertical collaboration—ISCs, SICs—are often used by focal firms to individually address sustainability aspects with their immediate upstream or downstream partners.

First, ISCs represent effective mechanisms in niche markets as reported by a CEO of a PUR-Manufacturer:

> "Due to the circumstance that we serve to 95% niche markets, on an individual customer-supplier relation, we will find solutions for the circular economy."

We find two supply chain levels in the PUR industry that are eligible to establish such ISCs effectively. The first level refers to Raw Material Producers operating at the very beginning of supply chains based on

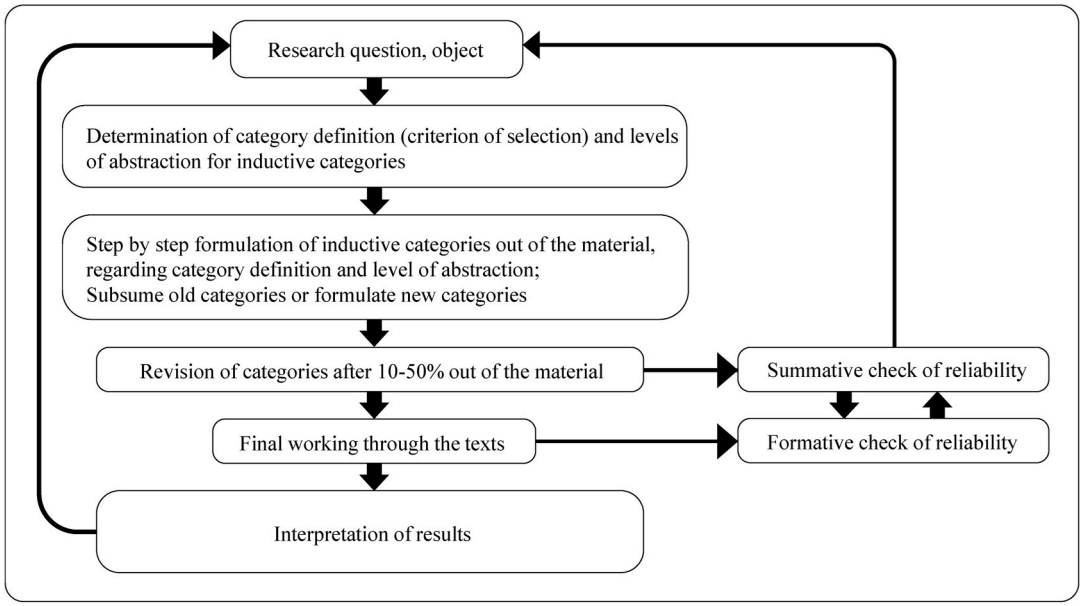

Fig. 3. Step model of inductive category development (adapted from Mayring, 2000).

individual producer-buyer relationships.

> "[S]ome chemical players are working along the supply chain with their customers … [T]hey approach circularity from different angles." (Secretary General, PUR trade association)

The second level refers to large multinational End-Application Producers & Retailers, who are able to easily enforce requirements upon individual suppliers due to their huge asymmetric power, as revealed by a Senior Manager from a large End-Application Producer & Retailer.

> "[F]rom a large-scale retailer perspective, [CE] is something that we have taken as part of our responsibility to do, to contribute back to the environment. And we can do that, because we are a large company."

> "[W]e work very much on long term partnerships. … We're working together with our supplier base … So, it's very much about optimizing that setup to deliver on the direction."

Second, SICs can be particularly used by End-Application Producers & Retailers to individually provide a commitment service to their suppliers since most suppliers are operating in highly competitive markets and are not able to address sustainability and CE initiatives by themselves:

> "Only End-Application Producers can specify materials and thus possess the ability to promote the use of [e.g.,] recyclates along the entire value chain." (CEO, PUR-Manufacturer)

> "We, as a PUR-Manufacturer, are just a link between Raw Material Producers and End-Application Producers & Retailers. We cannot decide if sustainable materials are used." (CEO, PUR-Manufacturer)

> "We, as a Distributor, act on behalf of our clients. The innovation needs to come from multinational corporations that represent a larger part of the vertical PUR supply chain." (Senior Manager, Distributor)

> "Mainly small foam molding companies are not able or only limitedly able to promote the CE because they are only a little chain link in the supply chain." (Senior Manager, Research Institute)

We conclude that governance mechanisms for vertical collaboration—ISCs and SICs—are particularly designed to approach CE in niche markets since customers in these markets possess an individual willingness to pay for circular materials and products. In mass markets, mostly large, well-organized End-Application Producers & Retailers commit to CE practices and thus provide SICs to their individual supply chain partners. This vertical approach rather follows an "optimization logic" for individual supply chain sustainability. However, such an incremental optimization is likely not able to address 'strong sustainability' for creating a functional CE.

5.2. Governance mechanisms for horizontal collaboration

We identified mechanisms for horizontal collaboration with respect to (5.2.1) CSCs—Pull (intra-industrial), Push—and (5.2.2) SCCs—Pull (inter-industrial), Pull (inter-sectoral)—that can potentially enable closed- and open-loop structures to facilitate the CE transition. However, our interviews indicate that those mechanisms for horizontal collaboration are different in functionality, practicability, and feasibility.

5.2.1. CSC-Pull by End-Application Producers & Retailers

We find that a CSC by a specific end-industry (e.g., mattresses & furniture, automotive, or building & construction) can be primarily established by End-Application Producers & Retailers, as noted by a CEO from a PUR consultancy:

> "If I look at car seats, a viable commitment is only useful from an OEM. If I look at the seat manufacturer, they cannot do it by themselves because the market is extremely competitive, and thus it is not possible to use sustainable and cost-intensive materials as an individual manufacturer."

> "If I look at mattresses and furniture, a commitment needs to be done by the Retailers due to their market power."

In the PUR industry, there already exist CSCs (e.g., branch agreements) to close loops for single end-industries. However, a large share of firms needs to collectively commit regarding the functionality as shared by a CEO of a Waste Management Company.

> "Competing End-Application-producers of PUR construction-foam-cans have already established a collaboration to jointly organize and operate a take-back and recycling system for such cans. From this example, I can say: 'it can work' … This is an industry solution where almost all relevant construction-foam-can producers participate."

> "Commitments on an End-Application & Retailer level in commodity markets can work if at least 90% of the relevant players commit."

In single end-industries, CSCs-Pull by End-Application Producers & Retailers can be effective governance mechanisms for closing and/or slowing resource loops, but they are still of limited value to enable open-loops.

> "If you think about commitments, you are on the end-application level. You have to look at the end-applications and then consider: Is the commitment that we take it back and bring it back into the loop? Or is the commitment that we prolong the usage phase and incentivize a recovery on the end-application level [?] … This can newly re-define the intrinsic value of products." (Partner & Managing Director, Strategy Consultancy)

Since those End-Application Producers & Retailers are commonly large and well-organized multinational brands, they possess immense reputational capital[6] since they directly face pressure from end-consumers to move towards sustainability and circularity.

> "E.g., IKEA is also a company which extremely takes care of its PR [public relations]. And of course, circular economy is a very big subject for the PR team. But what is the consequence of that? IKEA is a trend-setter; they are big enough to put new trends in the market." (Manager, Raw Material Producer)

> "How transparent are the effects of a product to the consumer regarding the sustainability? … In the purpose of commitments, you have to include consumer pressure by making the life cycle assessment more transparent. … This drives the consumer behavior." (Partner & Managing Director, Strategy Consultancy)

In contrast to Raw Material Producers that face limited end-consumer interaction, large well-known multinational brands can receive a "moral gratification" by offering CE-oriented products to their customers.

> "The value chain agents who put the product into circulation have to deal with CE because they could possess a viable sales argument." (Senior Manager, Research Institute)

> "We see advantages in the movement [towards CE]. And we also appreciate the communication with our customers, which is

[6] See for the discussion on reputational capital e.g., Fombrun (1996), Lemke and Petersen (2013), and Petersen and Lemke (2015).

exhausting and time-consuming, but we also experienced increased purchase orders from our clients." (CEO, PUR-Manufacturer)

We conclude that CSCs-Pull by End-Application Producers & Retailers operating in a specific end-industry are able to re-direct specific aspects of cost competition that previously inhibited circular practices, materials, and processes. As a result of collective commitments, the additional cost for circular materials and products can be jointly passed on to the consumers. However, CSCs-Pull are chiefly functional to slow and close resource loops in single end-industries.

5.2.2. CSC-Push by Raw Material Producers

We find that CSCs-Push by Raw Material Producers can be effective since chemical firms are able to innovate not only regarding closed-loop solutions for a single industry but to enable inter-industrial and inter-sectoral open-loops and thus may represent the enabling element for a functional CE as stated by several interviewees.

"Who else than the chemical industry can be the one to bring the solution [to a CE]? It will be the chemical industry that will do this … The chemical industry always has been innovative because they are basically at the beginning of the value chain, and if you look at the chemical companies, they all have their innovation budgets and a strong commitment to innovation." (Secretary General, PUR trade association)

"It is actually a collaboration between Raw Material Producers and other stakeholders that will define how to actually deal with the waste and how to find circular economy solutions." (Senior Manager, Raw Material Producer)

"The essential players for enabling a circular value chain are chemical companies and recyclers. Both need to develop instruments and agreements to ensure supply with secondary raw materials." (Partner & Managing Director, Strategy Consultancy)

However, Raw Material Producers operating at the very beginning of supply chains have only little reputational capital and thus face mostly limited pressure by end-consumers since they are not directly interacting with them, as observed by a former Senior Manager of a Raw Material Producer.

"The end-consumer is at the very end of supply chains. In my view, [she/he] has no power regarding PURs since [she/he] typically doesn't know that [offered products] even contain PURs."

We conclude that CSCs-Push by Raw Material Producers can be effective since they are designed to re-direct cost competition and thus encourage circular practices, materials, and processes as well as investments in circular-oriented innovation. As a possible consequence, downstream and upstream business players would be incentivized to follow the circularity ambitions and to include CE into their business activities. However, it is difficult for Raw Material Producers to establish CSCs-Push by themselves because they are at the very beginning of PUR supply chains and thus possess only little reputational capital and face only little end-consumer pressure. Consequently, there exist no or only minor incentives to collectively commit towards a CE. Furthermore, agreements on a horizontal level always comprise a risk of cartelization. So, a high degree of transparency would be needed to diminish risk exposure and avoid a cartel.

5.2.3. SCC-Pull by End-Application Producers & Retailers

In our study, we find SCCs-Pull by End-Application Producers & Retailers as novel mechanisms beyond what has been documented in the literature. On the one hand, CSCs by End-Application Producers & Retailers are of limited value to reduce resource losses. On the other hand, CSCs by Raw Material Producers & Retailers are unlikely to evolve due to incentivization issues. But SCCs-Pull by End-Applications Producers & Retailers can pave the way for inter-industrial (same sector) and inter-sectoral (other sectors) loops. The distinct feature of these mechanisms is that focal buyer firms operating in different industries (e.g., mattresses & furniture, automotive, building & construction) jointly provide a service for collective commitment to Raw Material Producers and thus facilitate a horizontal collaboration between the latter. This commitment service is able to provide incentives to Raw Material Producers to innovate towards CE solutions beyond single industries.

"For the CE … you have to bring together different parties, which have never worked together in the past, because at first glance there was no win-win." (CEO, PUR Consultancy)

"If you want to improve [solutions for a CE], [different companies] need to come together, [e.g.,] shoe manufacturer, mattress manufacturer, and waste management companies." (Senior Manager, Waste Management Company)

"[O]pen-loops [are] much smarter because I can leverage opportunities, which have not previously existed." (CEO, PUR Consultancy)

"For a CE, different end-industries' actors could jointly develop a standard or specification for CE-PUR or CE-polyols and therefore create a CE-oriented market for chemical companies. However, the agreement on such a specification or standard between the industries could be a bottleneck due to different requirements regarding performance or warranties." (Senior Manager, Strategy Consultancy)

Obviously, SCC-Pull mechanisms can be adequately used to incentivize supply chain actors to promote circularity towards closed- and open-loops. However, viable SCCs-Pull require (at least) three strategic deliberations by supply chain managers since, at the moment, there exist no or only minor incentives for inter-industrial and inter-sectoral collaboration as indicated by a Senior Manager of a Distributor.

"I am so much PUR-oriented in my daily business, although our firm is operating in other plastic segments as well … the exchange is very low."

Whereas enabling environments for individual industries already exist (to a certain extent) by industry associations (e.g., European Automobile Manufacturers Association, European Bedding Industries' Association, etc.), SCCs-Pull require an extension of enabling environments to encompass a commitment service beyond immediate industrial boundaries. Put differently, managers proactively need to develop their CE-enabling environment that then facilitates inter-industrial and -sectoral collaboration by partnering with e.g., NGOs, universities, industry associations, consultancies, etc.

"NGOs and [industry] associations can help to provide … commitment services and coordination functions." (Senior Manager, Research Institute)

"NGOs which bring [CE] into the debate need to exist. They should focus … on collaboration and should show solutions for the problems." (Senior Manager, Strategy Consultancy)

Second, supply chain managers have to focus on innovating a circular business model (and specifically its governance structure) to successfully operate in inter-industrial and -sectoral loops since the circular supply chain will likely re-frame the challenge of implementing circularity from an individual issue of the firm to a problem of its external supply network structure.

"[W]e must rethink our whole business model. We must relook at how we source materials; we need to look at how we produce products, how we move products everywhere, etc." (Senior Manager, End-Application Producer & Retailer)

> "It will be different products, so there will be new business developments, there will be new players involved in the [CE] and they need to be integrated, so there we are coming back to the governance. (Senior Manager, Chemical Company)

Third, managers are advised to build strategic alliances with specialized partners within and beyond immediate industry boundaries to realize small group transaction cost advantages for maintaining sustainable competitive advantages in evolving circular supply chain structures.

> "[Our] partnerships are working very well because everybody has their own specialist function. There is a company that is a specialist in waste collection, they're already doing that. And then there's a company that's a specialist in disassembly." (Senior Manager, End-Application Producer & Retailer)

We conclude that SCC-Pull governance mechanisms can facilitate the development of circular supply chain structures. To realize this, End-Application Producers & Retailers need to jointly collaborate and provide SCCs to Raw Material Producers. Put differently, mattress producers and retailers, automotive producers and retailers, and building companies need to collaborate for a CE across industries. Moving beyond a single sector, firms even need to consider partnerships with other sectors (e.g., Fast Moving Consumer Goods (FMCG)—PET bottle producers, etc.) to provide commitment services to firms operating at the very beginning of their supply chains.

6. Discussion, implications, and limitations

In this study, we provide a unique analysis of supply chain governance mechanisms for (1) vertical and (2) horizontal collaboration. As illustrated in Fig. 4, a focal firm (i.e., large End-Application Producer & Retailer) can individually commit (ISC) to circularity, which incentivizes the immediate suppliers to deliver circular-oriented semi-finished and finished goods (green box). The focal firm can also provide a SIC to its suppliers and thus incentivizes further upstream actors (dashed green box) to follow CE practices. However, as our study finds, this affects only a small part of the industry and commonly leads to individual supply chain "optimization" for (environmental) sustainability.

In contrast and as shown in Fig. 5, horizontal mechanisms—CSCs—cover larger parts of the industry. First, CSC-Pull (2-A) mechanisms are functional to close and/or slow intra-industrial loops in specific end-industries since competing firms at a specific end-industry level (blue box) collectively commit to promote the CE practices along their (joint) supply chains (e.g., voluntary industry standards). However, these mechanisms are of limited value to address inter-industrial and inter-sectoral partnerships and thus lead to a narrow focus on CE practices. Second, CSCs-Push (2-B) provide a promising avenue towards closed- and open-loops since Raw Material Producers at the very beginning of several end-industries' supply chains jointly promote CE practices (blue box). However, these mechanisms are unlikely to be established by those firms since, due to their little reputational capital, they lack the incentives to do so.

As illustrated in Fig. 5, the horizontal mechanisms—SCCs-Pull—can be used by focal firms operating in different end-industries to commit building closed- and open-loops for inter-industrial (2-C) and inter-sectoral (2-D) structures. First, SCCs-Pull (inter-industrial) describe the horizontal collaboration between firms from different end-industries but the same sector (PUR) (blue box) with the aim to incentivize Raw Material Producers (dashed blue box) promoting CE practices in the entire PUR sector. Second, SCCs-Pull (inter-sectoral) characterize the collaboration between firms from different end-industries and different sectors. In the context of PURs, there may exist expected synergies with PET

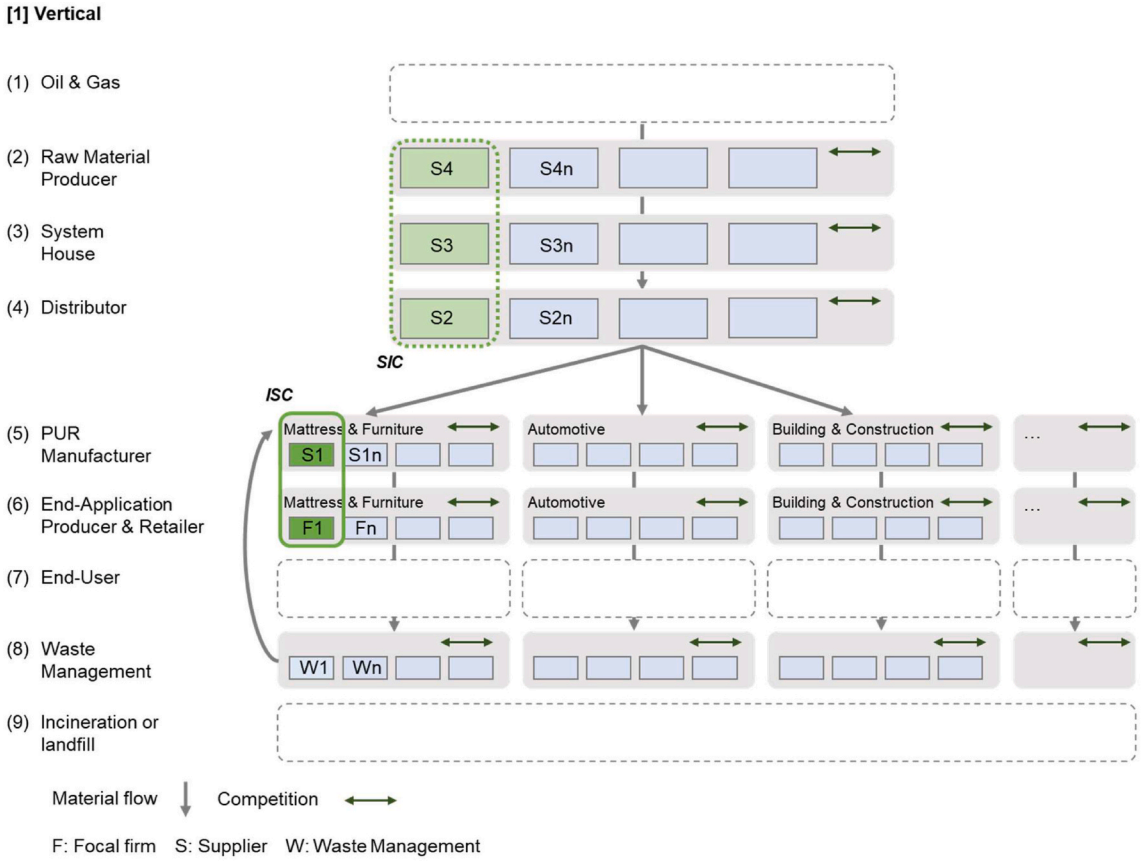

Fig. 4. Governance mechanisms for vertical collaboration.

Fig. 5. Governance mechanisms for horizontal collaboration.

since both contain, e.g., polyols and thus share a common origin regarding their raw material production. Hence, collaboration between firms beyond sectoral boundaries can incentivize Raw Material Producers (dashed blue box) to move towards CE practices for more than only one industry or sector and thus address the CE philosophy at its core.

(1) Gereffi's (1994) early dichotomy of supply chain "driveness" in either producer-driven chains or buyer-driven chains can be acknowledged as a conceptual turn towards governance for sustainable supply chains. Large parts of the SSCM literature focus on the latter investigating governance mechanisms for vertical collaboration by well-organized multinational brands (cf. Boström et al., 2015). However, our study indicates that both, producers in form of Raw Material Producers and buyers in form of End-Application Producers & Retailers, can simultaneously "drive" supply chains. But they face different exposures to public and consumer pressure and thus different importance of reputational capital (cf. Fombrun, 1996; Lemke and Petersen, 2013; Petersen and Lemke, 2015), which leads to different incentivization structures to promote a CE transition.

The literature shows evidence that collaborative and shared governance approaches in a vertical dimension can facilitate sustainability initiatives (Vurro et al., 2009; Gimenez and Sierra, 2013). Our findings indicate that vertical partnerships with suppliers and customers are positively connotated by interviewees to promote sustainability performance and business aspects simultaneously. However, this study reveals that vertical collaboration can be rather acknowledged as an "optimization" of individual supply chain sustainability and thus remains of limited value to conduct the 'radical shift' that is required for a breakthrough towards a CE.

In addition, our findings are in line with SSCM literature that discusses the positive role of third party collaboration with NGOs, universities, etc. (e.g., Koberg and Longoni, 2019). Our study indicates that such organizations can play a crucial role in paving the way for realizing not only sustainable supply chains but also circular supply chains. In sum, third parties need to be understood as constituting an enabling environment for implementing the sustainability ambitions of focal firms.

Although the SSCM literature mostly neglects horizontal collaboration between competitors (Chen et al., 2017), our findings reveal that particularly governance mechanisms for horizontal collaboration need to be acknowledged as crucial instruments required for circular supply chain development within and beyond industries and sectors.

(2) Since the literature on CE and CSCM is still at a nascent stage, some studies combining (S)SCM with a CE perspective primarily focus on vertical collaboration with suppliers and/or customers (e.g., De Oliveira et al., 2019; Kazancoglu et al., 2018). In contrast, our study is in line with CSCM literature that understands the vision towards a CE as a novel challenge to supply chain management in order to horizontally collaborate with intra-industrial competitors, competing supply chains, and further partners (e.g., De Angelis et al., 2018; Farooque et al., 2019; Govindan and Hasanagic, 2018). As demanded by De Angelis et al. (2018), we gain insights on governance mechanisms for horizontal (and vertical) collaboration based on a real-world context—the PUR industry. Paving the way for CSCM, our study moves beyond the discussion in extant literature and systematically distinguishes between governance mechanisms for horizontal collaboration, namely CSCs-Push, CSCs-Pull (intra--industrial), SCCs-Pull (inter-industrial), and SCCs-Pull (inter--sectoral). Whereas CSC-Push mechanisms are unlikely to be realized by joint efforts of Raw Material Producers due to incentivization issues, CSC-Pull mechanisms are of limited value because primarily they enable the intra-industrial slowing and closing of resource loops. Against this background, it is of vital importance that SCC-Pull mechanisms by leading End-Application Producers & Retailers can provide commitment services to Raw Material Producers and thereby incentivize these

actors to build inter-industrial and -sectoral loops in order to get closer to the CE vision.

In practice, we currently observe many CE initiatives in the PUR industry that are, however, still determined by vertical (and third party) collaboration. For example, the initiative by IKEA with the aim to become 100 % circular until 2030 includes only vertical collaboration with a PUR-supplier and a recycling company (IKEA/INGKA, 2021). Initiatives of leading Raw Material Producers like Covestro PUReSmart (Covestro, 2021), DOW Renuva (DOW, 2021), or BASF ChemCycling (BASF, 2021) are also driven by vertical collaboration and relationships with third parties (e.g., universities, equipment manufacturer, waste management companies, etc.). But horizontal mechanisms are largely absent in practice. Hence, the implementation of the CE philosophy is still at a nascent stage in practice since current closed-loop and CE initiatives follow an "optimization" of single industries and supply chains instead of providing solutions towards a 'radical shift' to re-design supply chain structures for a functional CE.

Our study includes several aspects that could inspire further research. First, we have studied a specific industry-context in Europe. Transferring our conceptualization of governance mechanisms to other supply chain structures, industries, and socio-cultural contexts, apart from PUR in the EU, invites further empirical studies. Second, our findings on governance mechanisms for horizontal collaboration call for a detailed investigation of specific mechanisms (e.g., branch agreements, voluntary standard developments, etc.) and even novel instruments to manage horizontal inter-industrial and -sectoral collaboration efficiently. Relatedly, this study opens the debate to investigate the crucial formalization aspect of governance mechanisms for a CE. Third, for the PUR industry, an in-depth analysis of barriers and enablers towards the CE transition is necessary to provide industry-specific recommendations to academia, practice, and politics. Fourth, further research needs to investigate sustainable and circular business model innovation (including the appropriate governance structures) to operate in inter-industrial and -sectoral loops as well as the role of the CE-enabling environment to CSCM in detail. Finally, since a governance perspective on SSCM, CE, and CSCM is still emerging, more conceptual approaches and empirical work are needed to reveal synergies and even dissonances between these concepts. Hence, we call for future research to shift the focus into the emerging governance direction and to constructively criticize our work to advance this important field of research that we believe can create new significant momentum.

7. Conclusion

CSCM for a functional CE faces governance challenges since organizations need to collaborate with other actors within and outside of industries and sectors. This article contributes to the literature by uncovering governance mechanisms for vertical and, in particular, for horizontal inter-organizational collaboration. We show remarkable new findings to extant research by revealing that vertical mechanisms (from SSCM) are of limited value to enable successful CSCM, whereas horizontal mechanisms—particularly SCCs—are functional to pave the way for circular supply chain structures. We argue that primarily governance mechanisms for horizontal collaboration in interplay with the development of a CE-enabling environment, the innovation of a circular business model (and its governance), and the building of strategic alliances with specialized partners hold an immense potential to facilitate supply chain managers implementing CSCM practices in a real-world context.

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CRediT authorship contribution statement

Felix Carl Schultz: Conceptualization, Data curation, Methodology, Investigation, Validation, Visualization, Writing – original draft, Project administration. **Sebastian Everding:** Investigation, Validation, Writing – original draft. **Ingo Pies:** Conceptualization, Validation, Supervision, Writing – review & editing.

Declaration of competing interest

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

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References

Ahi, P., Searcy, C., 2013. A comparative literature analysis of definitions for green and sustainable supply chain management. J. Clean. Prod. 52, 329–341.

Akindoyo, J.O., Beg, M.D.H., Ghazali, S., Islam, M.R., Jeyaratnam, N., Yuvaraj, A.R., 2016. Polyurethane types, synthesis and applications – a review. RSC Adv. 6, 114453–114482.

Alvarez, G., Pilbeam, C., Wilding, R., 2010. Nestlé Nespresso AAA sustainable quality program: an investigation into the governance dynamics in a multi-stakeholder supply chain network. Supply Chain Manag.: An Int. J. 15 (2), 165–182.

Aminoff, A., Kettunen, O., 2016. Sustainable supply chain management in a circular economy-towards supply circles. In: Setchi, R., Howlett, R.J., Liu, Y., Theobald, P. (Eds.), Sustainable Design and Manufacturing 2016. Springer International Publishing, Cham, pp. 61–72.

Ariño, A., LeBaron, C., Milliken, F.J., 2016. Publishing qualitative research in academy of management discoveries. Acad. Manag. Discov. 2 (2), 109–113.

BASF, 2021. Chemical recycling of plastic waste. Available online. https://www.basf.com/global/en/who-we-are/sustainability/we-drive-sustainable-solutions/circular-economy/chemcycling.html, 20th of May 2021.

Batista, L., Bourlakis, M., Smart, P., Maull, R., 2018. In search of a circular supply chain archetype – a content-analysis-based literature review. Prod. Plann. Contr. 29 (6), 438–451.

Beckmann, M., Hielscher, S., Pies, I., 2014. Commitment strategies for sustainability: how business firms can transform trade-offs into win-win outcomes. Bus Strat. Environ 23 (1), 18–37.

Berry, J.M., 2002. Validity and reliability issues in elite interviewing. PS Political Sci. Polit. 35 (4), 679–682.

Bocken, N., Olivetti, E.A., Cullen, J.M., Potting, J., Lifset, R., 2017. Taking the circularity to the next level: a special issue on the circular Economy. J. Ind. Ecol. 21 (3), 476–482.

Boström, M., Jönsson, A.M., Lockie, S., Mol, A., Oosterveer, P., 2015. Sustainable and responsible supply chain governance: challenges and opportunities. J. Clean. Prod. 107, 1–7.

Brandenburger, A.M., Nalebuff, B.J., 1996. Co-opetition: A Revolutionary Mindset that Combines Competition and Cooperation in the Marketplace. Harvard Business School Press, Boston, MA.

Bressanelli, G., Perona, M., Saccani, N., 2019. Challenges in supply chain redesign for the Circular Economy: a literature review and a multiple case study. Int. J. Prod. Res. 57 (23), 7395–7422.

Brice, A., November 2019. 2019. PU players target circular economies. Urethanes Technology International. 36 (35th Anniversary Issue 26–29.

Brockhaus, S., Kersten, W., Knemeyer, A.M., 2013. Where do we go from here? progressing sustainability implementation efforts across supply chains. J. Bus. Logist. 34 (2), 167–182.

Carter, C.R., Rogers, D.S., 2008. A framework of sustainable supply chain management: moving toward new theory, Int. J. Phys. Distr. & Log. Manag 38 (5), 360–387.

Chen, I.J., Paulraj, A., 2004. Understanding supply chain management: critical research and a theoretical framework. Int. J. Prod. Res. 42 (1), 131–163.

Chen, L., Zhao, X., Tang, O., Price, L., Zhang, S., Zhu, W., 2017. Supply chain collaboration for sustainability: a literature review and future research agenda. Int. J. Prod. Econ 194, 73–87.

Crosina, E., Pratt, M.G., 2019. Toward a model of organizational mourning: the case of former Lehman Brothers bankers. Acad. Manag. J. 62 (1), 66–98.

Covestro, 2021. Closing cycles for polyurethane mattresses. Available online. https://press.covestro.com/news.nsf/id/closing-cycles-for-polyurethane-mattresses, 04th of April 2021.

De Oliveira, M.C.C., Machado, M.C., Jabbour, C.J.C., de Sousa Jabbour, A.B.L., 2019. Paving the way for the circular economy and more sustainable supply chains. Manag. Environ. Qual. Int. J. 30 (5), 1095–1113.
De Angelis, R., Howard, M., Miemczyk, J., 2018. Supply chain management and the circular economy: towards the circular supply chain. Prod. Plann. Contr. 29 (6), 425–437.
DOW, 2021. The RENUVA program. Available online. https://corporate.dow.com/en-us/science-and-sustainability/2025-goals/renuva-program.html, 26th of April 2021.
European Commission, 2019. Recycling construction foams. Available online. https://ec.europa.eu/easme/en/news/recycling-construction-foams, 25th of March 2021.
Farooque, M., Zhang, A., Thürer, M., Qu, T., Huisingh, D., 2019. Circular supply chain management: a definition and structured literature review. J. Clean. Prod. 228, 882–900.
Fischer, A., Pascucci, S., 2017. Institutional incentives in circular economy transition: the case of material use in the Dutch textile industry. J. Clean. Prod. 155, 17–32.
Fombrun, C.J., 1996. Reputation: Realizing Value from the Corporate Image. Harvard Business School Press, Boston, MA.
Formentini, M., Taticchi, P., 2016. Corporate sustainability approaches and governance mechanisms in sustainable supply chain management. J. Clean. Prod. 112, 1920–1933.
Genovese, A., Acquaye, A.A., Figueroa, A., Koh, S.C.L., 2017. Sustainable supply chain management and the transition towards a circular economy: evidence and some applications. Omega 66, 344–357.
Gereffi, G., 1994. The organization of buyer-driven global commodity chain: how U.S. retailers shape overseas production networks. In: Gereffi, G., Korzeniewicz, M. (Eds.), Commodity Chains and Global Capitalism. Praeger, Westport, pp. 95–122.
Gereffi, G., 1999. A Commodity Chains Framework for Analyzing Global Industries. Duke University, Durham. USA.
Gereffi, G., Humphrey, J., Sturgeon, T., 2005. The governance of global value chains. Rev. Int. Pol. Econ 12 (1), 78–104.
Ghisellini, P., Cialani, C., Ulgiati, S., 2016. A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems. J. Clean. Prod. 114, 11–32.
Gimenez, C., Sierra, V., 2013. Sustainable supply chains: governance mechanisms to greening suppliers. J. Bus. Ethics 116 (1), 189–203.
Gimenez, C., Tachizawa, E.M., 2012. Extending sustainability to suppliers: a systematic literature review. Supply Chain Manag. An Int. J. 17 (5), 531–543.
Gioia, D.A., Corley, K.G., Hamilton, A.L., 2013. Seeking qualitative rigor in inductive research: notes on the Gioia methodology. Organ. Res. Methods 16 (1), 15–31.
Govindan, K., Hasanagic, M., 2018. A systematic review on drivers, barriers, and practices towards circular economy: a supply chain perspective. Int. J. Prod. Res. 56 (1–2), 278–311.
Govindan, K., Seuring, S., Zhu, Q., Azevedo, S.G., 2016. Accelerating the transition towards sustainability dynamics into supply chain relationship management and governance structures. J. Clean. Prod. 112, 1813–1823.
Gurtu, A., Searcy, C., Jaber, M., 2015. An analysis of keywords used in the literature on green supply chain management. Manag. Res. Rev. 38 (2), 166–194.
Handcock, M.S., Gile, K.J., 2011. Comment: on the concept of snowball sampling. Socio. Methodol. 41 (1), 367–371.
Hansen, E.G., Revellio, F., 2020. Circular value creation architectures: make, ally, buy, or laissez-faire. J. Ind. Ecol. https://doi.org/10.1111/jiec.13016.
Howard, M., Hopkinson, P., Miemczyk, J., 2019. The regenerative supply chain: a framework for developing circular economy indicators. Int. J. Prod. Res. 57 (23), 7300–7318.
Hussain, M., Malik, M., 2020. Organizational enablers for circular economy in the context of sustainable supply chain management. J. Clean. Prod. 256, 120375.
IKEA/INGKA, 2021. IKEA value chain collaboration brings circular mattress one step closer, 15th of May 2021. https://www.ingka.com/news/ikea-value-chain-collaboration-brings-circular-mattress-one-step-closer/.
Kazancoglu, Y., Kazancoglu, I., Sagnak, M., 2018. A new holistic conceptual framework for green supply chain management performance assessment based on circular economy. J. Clean. Prod. 195, 1282–1299.
Kirchherr, J., Reike, D., Hekkert, M., 2017. Conceptualizing the circular economy: an analysis of 114 definitions. Res., Cons. and Rec. 127, 221–232.
Kirchherr, J., van Santen, R., 2019. Research on the circular economy: a critique of the field. Res., Cons. and Rec. 151, 104480.
Koberg, E., Longoni, A., 2019. A systematic review of sustainable supply chain management in global supply chains. J. Clean. Prod. 207, 1084–1098.
Korhonen, J., Honkasalo, A., Seppälä, J., 2018a. Circular economy: the concept and its limitations. Ecol. Econ. Times 143, 37–46.
Korhonen, J., Nuur, C., Feldmann, A., Birkie, S.E., 2018b. Circular economy as an essentially contested concept. J. Clean. Prod. 175, 544–552.
Lahane, S., Kant, R., Shankar, R., 2020. Circular supply chain management: a state-of-art review and future opportunities. J. Clean. Prod. 258, 120859.
Larrain, M., Van Passel, S., Thomassen, G., Kresovic, U., Alderweireldt, N., Moerman, M., Billen, P., 2020. Economic performance of pyrolysis of mixed plastic waste: open-loop versus closed-loop recycling. J. Clean. Prod. 270, 122442.
Lai, K.-h., Wong, C.W.Y., Lun, Y.H.V., 2014. The role of customer integration in extended producer responsibility: a study of Chinese export manufacturers. Int. J. Prod. Econ 147, 284–293.
Lemke, F., Petersen, H.L., 2013. Teaching reputational risk management in the supply chain. Supply chain manag.: an int. J. 18 (4), 413–429.
Mayring, P., 2000. Qualitative content analysis [28 paragraphs]. Forum qualitative sozialforschung. Forum Qual. Soc. Res. 1 (2). Art. 20. Available online. http://www.qualitative-research.net/index.php/fqs/article/view/1089/2384, 05th of February 2020.
Mayring, P., 2014. Qualitative content analysis: theoretical foundation, basic procedures and software solution. Available online. https://www.ssoar.info/ssoar/handle/document/39517, 05th of February 2020.
Miles, M.B., Huberman, A.M., Saldana, J., 2013. Qualitative Data Analysis, A Methods Sourcebook, third ed. Sage Publications Ltd.
Murray, A., Skene, K., Haynes, K., 2017. The circular economy: an interdisciplinary exploration of the concept and application in a global context. J. Bus. Ethics 140 (3), 369–380.
Nasir, M.H.A., Genovese, A., Acquaye, A.A., Koh, S.C.L., Yamoah, F., 2017. Comparing linear and circular supply chains: a case study from the construction industry. Int. J. Prod. Econ. 183, 443–457.
Panigrahi, S.S., Bahinipati, B., Jain, V., 2019. Sustainable supply chain management: a review of literature and implications for future research. Manag. Environ. Qual. Int. J. 30 (5), 1001–1049.
Petersen, H.L., Lemke, F., 2015. Mitigating reputational risks in supply chains. Supply Chain Manag.: an Int. J. 20 (5), 495–510.
Pilbeam, C., Alvarez, G., Wilson, H., 2012. The governance of supply networks: a systematic literature review. Supply Chain Manag.: an Int. J. 17 (4), 358–376.
Pies, I., 2016. The ordonomic approach to order ethics. In: Lütge, C., Mukerji, N. (Eds.), Order Ethics: an Ethical Framework for the Social Market Economy. n.P. Springer International Publishing, pp. 19–35.
Pies, I., Beckmann, M., Hielscher, S., 2010. Value creation, management competencies, and global corporate citizenship: an ordonomic approach to business ethics in the age of globalization. J. Bus. Ethics 94 (2), 265–278.
Pies, I., Beckmann, M., Hielscher, S., 2014. The political role of the business firm: an ordonomic concept of corporate citizenship developed in comparison with the aristotelian idea of individual citizenship. Bus. For. Soc. 53 (2), 226–259.
Pies, I., Hielscher, S., Beckmann, M., 2009. Moral commitments and the societal role of business: an ordonomic approach to corporate citizenship. Bus. Ethics Q 19, 375–401.
Pies, I., Hielscher, S., Everding, S., 2020. Do hybrids impede sustainability? How semantic reorientations and governance reforms can produce and preserve sustainability in sharing business models. J. Bus. Res. 115, 174–185.
PlasticsEurope, 2020. Plastics - the facts 2020, 10th of May 2021. https://www.plasticseurope.org/de/resources/publications/4312-plastics-facts-2020.
Potting, J., Hekkert, M., Worrell, E., Hanemaaijer, A., 2017. Circular economy: measuring innovation in the product chain. PBL – Netherlands Environmental Assessment Agency, 15th of May 2021. https://www.pbl.nl/sites/default/files/downloads/pbl-2016-circular-economy-measuring-innovation-in-product-chains-2544.pdf.
Sancha, C., Wong, C.W., Thomsen, C.G., 2016. Buyer-supplier relationships on environmental issues: a contingency perspective. J. Clean. Prod. 112, 1849–1860.
Simón, D., Borreguero, A.M., de Lucas, A., Rodríguez, J.F., 2018. Recycling of polyurethanes from laboratory to industry, a journey towards the sustainability. Waste Manag. 76, 147–171.
Soylu, A., Oruc, C., Turkay, M., Fujita, K., Asakura, T., 2006. Synergy analysis of collaborative supply chain management in energy systems using multi-period MILP. Eur. J. Oper. Res. 174 (1), 387–403.
Strike, V.M., Rerup, C., 2016. Mediated sensemaking. Acad. Manag. J. 59 (3), 880–905.
Tachizawa, E.M., Wong, C.Y., 2015. The performance of green supply chain management governance mechanisms: a supply network and complexity perspective. J. Supply Chain Manag. 51 (3), 18–32.
Ugarte, L., Calvo-Correas, T., Gonzalez-Gurrutxaga, I., Peña-Rodriguez, C., Etxeberria, O., Corcuera, M.A., Eceiza, A., 2018. Towards circular economy: different strategies for polyurethane waste recycling and the obtaining of new products. Proceedings 2 (23), 1490.
UN Environment Programme, 2018. Single-use plastics: a roadmap for sustainability. Available online. https://wedocs.unep.org/handle/20.500.11822/25496, 27th of November 2020.
Vermeulen, W.J., Seuring, S., 2009. Sustainability through the market - the impacts of sustainable supply chain management: introduction. Sustain. Dev. 17 (5), 269–273.
Voss, C., Tsikriktsis, N., Frohlich, M., 2002. Case research in operations management. Int. J. Oper. Prod. Manag. 22 (2), 195–219.
Vurro, C., Russo, A., Perrini, F., 2009. Shaping sustainable value chains: network determinants of supply chain governance models. J. Bus. Ethics 90 (4), 607–621.
Williamson, O.E., 1983. Credible commitments: using hostages to support ex-change. Am. Econ. Rev. 73 (4), 519–540.
Williamson, O.E., 1991. Comparative economic organization: the analysis of discrete structural alternatives. Adm. Sci. Q. 36 (2), 269–296.
Williamson, O.E., 1996. The Mechanisms of Governance. Oxford University Press.
Williamson, O.E., 1998. Transaction cost economics: how it works; where it is headed. Economist 146 (1), 23–58.
Williamson, O.E., 2010. Transaction cost economics: the natural progression. Am. Econ. Rev. 100 (3), 673–690.
Yang, C., Lien, S., 2018. Governance mechanisms for green supply chain partnership. Sustainability 10 (8), 2681.
Zhang, L., Wang, J., You, J., 2015. Consumer environmental awareness and channel coordination with two substitutable products. Eur. J. Oper. Res. 241 (1), 63–73.
Zhu, Q., Feng, Y., Choi, S.B., 2017. The role of customer relational governance in environmental and economic performance improvement through green supply chain management. J. Clean. Prod. 155, 46–53.