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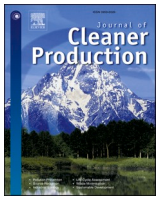

Understanding the relationship between institutional pressures, supply chain integration and the adoption of circular economy practices

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ABSTRACT

This paper explores the role of institutional pressures and supply chain integration in the adoption of Circular Economy practices. Using a Delphi-like approach and leveraging on a panel of 30 experts in the field of Circular Economy, this study aims to gain additional insights into how coercive, normative, and mimetic pressures can drive the implementation of circular supply chains. The findings reveal a hierarchy of institutional pressures, with coercive market and regulatory pressures having a greater impact compared to normative and mimetic pressures. Additionally, the study identifies various responses to these pressures, illustrating different trajectories towards the implementation of Circular Economy practices. Furthermore, the research investigates the role of supply chain integration. Generally, a higher level of supply chain integration can amplify the effect of institutional pressures, promoting the adoption of incremental Circular Economy practices. However, it is noteworthy to mention that supply chain integration may also hinder the adoption of more radical Circular Economy approaches, favouring the retention of linear supply chains.

1. Introduction

The Circular Economy (CE) paradigm has emerged as an alternative to the linear production-consumption model, aiming to provide the stimulus for the development of a new economic system characterised by cyclical and regenerative material and energy flows (Geissdoerfer et al., 2017). Such an industrial model is expected to contribute to positive environmental, social, and economic transformations for achieving sustainable development (Korhonen et al., 2018).

The growing attention that the CE concept has been drawing over the last decade has also generated efforts aimed at exploring the role of factors that could foster this transition. An increasing number of relevant publications in these recent years have been concerned with the identification and classification of existing circular business models (Rosa et al., 2019; Henry et al., 2020; Vegter et al., 2020), the effectiveness of current policies (Domenech and Bahn-Walkowiak, 2019; Vanhamäki et al., 2020; Arsova et al., 2022) as well as potential barriers, including cultural, political, market and technological constraints (de Jesus and Mendonça, 2018; Kirchherr et al., 2018). The implementation of CE principles in practical applications heavily relies on the development of circular supply chains (CSCs), which extend beyond the traditional linear supplier-manufacturer-customer networks to include new actors (e.g., collection and sorting contractors; re-processors; remanufacturers) as well as facilitate horizontal collaboration across different sectors (Genovese et al., 2017; De Angelis et al., 2018).

Considering their broad relevance to the transition towards more sustainable futures (Kauppi and Hannibal, 2017; Venkatesh et al., 2020), institutional pressures (hereinafter referred to as IPs) have been identified as a key driver to the development of CE approaches (Zeng et al., 2017; Ranta et al., 2018; Calzolari et al., 2021; Do et al., 2022). Notably, coercive, normative, and mimetic pressures can significantly impact firms' decisions to adopt a CE strategy. Nonetheless, in order to realise a shift towards CSCs, it is necessary to increase the capacity of involved companies to share information and knowledge with their partners to reduce uncertainty and resource dependency (Herczeg et al., 2018; Berardi and de Brito, 2021). Given its relevance to the development of such capabilities, the enhancement of supply chain integration (SCI) has been highlighted as a key strategy for fostering collaboration across circular supply chain networks (Elia et al., 2020; Pinto and Diemer, 2020; Di Maria et al., 2022).

In this study, the aim is to challenge and enhance the conceptual framework proposed by Calzolari et al. (2021) which describes the

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adoption of CE practices as a supply chain process, highlighting the role of IPs and SCI. This framework emerged from a literature review and an analysis of corporate sustainability reports from the top 50 European Multi-National Enterprises (MNEs) of the Global Fortune 500. It is argued that higher integration with suppliers and customers amplifies the effect of IPs on the supply chain adoption of CE practices. Utilising a Delphi-like approach, this paper aims to validate and enhance the framework through interaction with a panel of experts. According to the findings, SCI has a conflicting role in the relationship between IPs and the implementation of CE strategies, as it can facilitate the adoption of some practices, and inhibit others. Additionally, reactions to IPs have been identified.

The remainder of the document is arranged as follows. Section 2 provides a review of the literature focusing on the role of IPs and SCI on the adoption of CE practices. Section 3 provides an overview of the research method employed, while Section 4 illustrates the findings. In Section 5, a revised framework is presented, followed by the study's conclusions in Section 6.

2. Literature review

IPs appear to be a factor to consider when examining the adoption of CE practices from a supply chain management (SCM) perspective (De Angelis et al., 2018; Liu et al., 2018). In today's globalised production systems, these pressures occur at the supply chain level rather than within the boundaries of individual firms (Ketchen and Hult, 2007; Hofstetter et al., 2021). In addition, since the misalignment of supply chain incentives is a key obstacle to CE adoption (Rizos et al., 2016), the way a supply chain is organised can influence the diffusion of CE practices across production networks (Bressanelli et al., 2019). SCI is crucial in achieving a high level of coordinated planning allowing firms to combine the technical knowledge and skills necessary for developing circular capabilities (De Angelis et al., 2018). The following sub-sections critically examine the literature streams looking at the influences of IPs and SCI on the transition towards CSCs.

2.1. Institutional pressures and the adoption of circular economy practices

In order to establish and maintain legitimacy with different groups of stakeholders, organisations tend to respond to pressures exerted by other entities operating within the same institutional field (DiMaggio and Powell, 1983). This process is described as institutional isomorphism and operates through three distinct mechanisms, namely coercive, mimetic, and normative pressures. Coercive pressures can stem from regulatory bodies as well as from other organisations upon which the firm is dependent (such as resource-dominant organisations, suppliers, customers, and investors). Thus, organisations make decisions in accordance with laws and regulations to avoid sanctions (coercive regulatory pressures) and comply with demands and requests imposed by actors in the supply chain (coercive market pressures) (Kauppi and Luzzini, 2022). In the context of the transition towards a CE, such pressures can also be linked to active and passive behaviours on the part of companies, referring to their ability to adopt CE-oriented practices. While in the first scenario a company proactively adopts CE practices and integrates them into its core business practices, a passive behaviour involves merely complying with external pressures without actively seeking additional CE initiatives.

Normative pressures arise from shared values among organisations and employees within an industry or professional association, where organisations are influenced not only by formal rules but also by what is deemed appropriate and socially accepted due to norms and standards.

Finally, mimetic pressures involve the adoption of shared conceptions and beliefs, as organisations mimic successful social actors that have established themselves through taken-for-granted dynamics and best practices (DiMaggio and Powell, 1983; Scott, 2003). For instance, the action of a leading company adopting sustainable practices might prompt other companies in the same supply chain or in the wider industry to embrace similar approaches in order to maintain market competitiveness. The adoption of environmental assessment tools, which have been successfully employed by other enterprises in the same sector, is an example of mimetic isomorphism (Kauppi and Luzzini, 2022).

Institutional theory has been extensively used in SCM research to explain the adoption of practices, organisational structures, or technologies (Zhu and Geng, 2013; Touboulic and Walker, 2015; Kauppi and Luzzini, 2022). Looking at specific types of practices, research has shown that organisations approach sustainability mainly as a means of complying with legislation requirements and improving their brand image, rather than as profit-seekers (Brønn and Vidaver-Cohen, 2009). As such, IPs represent one of the main drivers for the adoption of sustainable practices in organisations and their supply chains, reflecting corporations' alignment with triple-bottom-line strategies (Ellram and Tate, 2016).

Recent empirical studies have tried to explain why and how supply chains adopt CE practices, looking at which specific pressures are most important in inducing organisations to take action. Initially, stricter environmental regulations were identified as a key factor (Geng et al., 2009; Mathews and Tan, 2011; Herczeg et al., 2018) in steering production and consumption systems towards a cleaner pathway, especially in contexts where economic planning plays a more prominent role.

However, research argues that legislation alone is insufficient to enforce a systemic change within global supply chains (Ranta et al., 2018; Jain et al., 2020). Instead, a combination of IPs is needed to drive the adoption of CE initiatives (Ranta et al., 2018). Along with legislation, normative and mimetic factors play an important role in driving isomorphic actions and the adoption of CE practices. Organisations may use CE approaches in their reporting to legitimise their position, attaching greater importance to standards, certifications, and industry best practices than to legislation (Dagiliene et al., 2020).

In addition to legitimacy reasons, organisations also adopt CE practices to increase their efficiency. The most important pressures depend on the level of market uncertainty and the presence of barriers. In detail, when uncertainty is high, the adoption of CE practices is expected to be driven more by legislative and mimetic factors, whereas when uncertainty is low, companies adopt CE practices to increase their efficiency (Do et al., 2022).

2.2. The relationship between SCI and the adoption of CE practices

In order to explain how supply chains are organised, the SCM literature has widely employed the SCI concept. SCI involves a set of constructs including information exchange, the presence of collaborative activities, and the alignment of strategic interests with key suppliers and customers (Frohlich and Westbrook, 2001; Leuschner et al., 2013).

Considering it as a specific capability of firms, studies have highlighted SCI as an enabling factor in facilitating the adoption of sustainable practices, which can also interact with IPs (Sancha et al., 2015). In the context of the transition towards a CE, the configuration of a supply chain plays a critical role in determining the ease with which CE practices can be diffused across it (Zhu et al., 2011). CE literature indicates that major obstacles to the transition to a CE can arise when companies have little influence over their fragmented and global supply chains (Berardi and de Brito, 2021), due to the misalignment of incentives and limited visibility beyond the first tier (Dou et al., 2018; Mejías et al., 2019). Addressing these barriers and improving ties between companies can support the adoption of CE practices, as in the case of industrial symbiosis networks (Herczeg et al., 2018) or industrial districts (Bressanelli et al., 2022). In these contexts, participating organisations can significantly improve the level of coordinated planning; this can enable them to identify and evaluate innovative ways of utilising their by-products while minimising uncertainty regarding the quality and quantity of waste (de Abreu and Ceglia, 2018; Herczeg et al.,

2018).

Consequently, inter-organisational collaboration in the supply chain is expected to facilitate the adoption of CE practices (Cricelli et al., 2021) and lead to a subsequent improvement in sustainability performance (Sudusinghe and Seuring, 2021). SCI can also mediate the impact of Industry 4.0 technologies on the improvement of CE performance (Di Maria and De Marchi, 2022). Recent empirical studies have explored the influence of information sharing and knowledge transfer on the implementation of CE practices in supply chains, highlighting the potential role of establishing long-term oriented relationships and joint decision-making structures (Elia et al., 2020; Calzolari et al., 2021).

2.3. A look at the state of the practice

Empirical research has recently sought to address the gap identified by Kirchherr et al. (2018) by investigating the adoption of CE practices in larger samples of companies (Gusmerotti et al., 2019; Dagiliene et al., 2020; Cricelli et al., 2021). Two papers have examined the role of SCI in the adoption of CE practices by analysing large datasets of secondary data to assess the current state of the practice (Elia et al., 2020; Calzolari et al., 2021), reaching similar conclusions.

The first analysis focuses on 98 companies participating in the CE100 program[1] (Elia et al., 2020). These organisations are considered leading first movers in the adoption of CE-driven innovation. The companies are classified based on the CE objectives they pursue (such as reducing inputs and the use of natural resources, and lowering emission levels), the life cycle phases they affect (e.g., material input, design, production, consumption, end-of-life), and the practices they implement (e.g., circular product design and production, business models, cascade/reverse cycle skills, cross-cycle, and cross-sector collaboration). The authors examine the extent to which the level of SCI is correlated to the adoption of CE practices and objectives, defining clusters of organisations characterised by similar levels of integration (single-tier integration, multi-tier integration, full integration). A higher level of SCI is positively associated with the number of CE objectives pursued, the number of product/services life-cycle analysis (LCA) phases impacted, and the impact of the organisations' actions.

The conceptual framework proposed by Calzolari et al. (2021) (Fig. 1) was based on the development and analysis of a database from a sample of 50 European MNEs. The CE practices were categorised according to the level of implementation (identifying five incremental implementation stages), and the involvement of supply chain partners (distinguishing between internal CE practices and Circular Supply Chain practices). Also, CE practices were distinguished according to their types, referring to different R-imperatives, referring to recent classifications introduced by the European Commission (2020).

- *Reduce*: products are innovated in order to decrease overall resource consumption, also rethinking and redefining their functions.
- *Reuse*: products' lifecycles are extended through repairing, preventive maintenance, and refurbishing actions; products and components can then be reutilised according to their original functions.
- *Recycle*: end-of-life products, parts, components, and materials are reprocessed in order to manufacture new products, parts, components, and materials.
- *Recover*: energy is recovered from by-products or waste, either directly or through the production of alternative fuels.
- *Renewable energy & Resource efficiency*: incremental efficiency improvements of production or logistics processes are sought, or renewables as a source of energy are adopted. In any case, linear flows of materials are not challenged.

[1] CE100 is a programme from the Ellen Macarthur Foundation that involves a large number of large multi-national enterprises with an interest in Circular Economy.

SCI was measured using the International Manufacturing Strategy Survey (IMSS) measurement items (i.e., sharing information with key suppliers/customers, joint decision-making, collaborative approaches, and system coupling) (Wiengarten and Longoni, 2015). According to the findings, the level of adoption of CE practices is aligned with the level of integration with supply chain partners. Thus, supply chains that exhibit higher levels of SCI demonstrate greater adoption of both internal CE practices and Circular Supply Chain practices compared to less integrated supply chains.

Studies exploring SCI's impact on CE practice adoption indicate a trend toward more systematic CE integration within MNE supply chains. In detail, organizations displaying high levels of SCI seem poised to embrace CE practices more systematically. High levels of SCI appear to be a key characteristic of organisations that have adopted more practices at higher levels of implementation, as well as companies that have planned to take more actions and have more objectives (Bressanelli et al., 2022; Elia et al., 2020). Considering the need to redesign business operations to accommodate the adoption of CE practices, a higher level of SCI has a direct impact on the number of product life-cycle phases impacted (Elia et al., 2020). This level of integration allows to tackle challenges throughout the entire lifespan of a product as well as to open avenues for identifying opportunities and exploring innovative ways for material recovery and reuse, repair and maintenance services, and developing circular business models.

These analyses also align with the literature that criticises the limitations of incumbent organisations' CE approach, which often adopts a reductionist interpretation (Ranta et al., 2018; Calzolari et al., 2021). Such a reductionist perspective corresponds to the deliberate oversight of reduce and reuse practices, due to need for deeper re-design of current business models, which could have a direct effect on the sales of new products (e.g., the reduction in future sales due to the manufacturing of products that are easier to repair) and overall growth objectives of organisations (Calzolari et al., 2021). Most of the actions focus on end-of-life material recovery and recycling, with less attention given to product reuse or truly circular business models.

2.4. Development of research questions

While some studies are starting to examine the relationship between IPs and the adoption of CE practices, little is known regarding how these pressures are exemplified in the context of firms' operations (Arranz et al., 2022). While some publications have CE and IPs in the same conceptual framework, they have not directly explored their relationship (Bag and Pretorius, 2022; Bag et al., 2022). Other studies have conceptualised CE as a performance construct that does not reflect any intention to implement specific CE practices (Jain et al., 2020). The first research gap this paper aims to address is getting an understanding of how IPs affect the adoption of CE practices by companies, also aiming at clarifying the various roles played by different categories of pressures.

On the other hand, the SCI concept was developed according to the traditional linear thinking of SCM around inputs (suppliers) and outputs (customers), which entails a forward physical flow of deliveries from suppliers to customers and a backward flow of information in the form of orders (Frohlich and Westbrook, 2001). The introduction of new actors such as waste collectors and remanufacturers in circular supply networks has added a layer of complexity as the direction and type of these flows significantly differ (Braz and de Mello, 2022). This controversy highlights the need for further exploratory research, rather than delving immediately into some hypothesis testing. Given also that the link between SCI with performance improvement is becoming unclear (Braz and de Mello, 2022), the initial evidence about the link to CE practices adoption deserves further investigation. In detail, this study will attempt to provide some insights into the ways that SCI can drive the adoption of CE practices, highlighting the need for supply chain visibility and transparency, as well as the important role of key suppliers and customers.

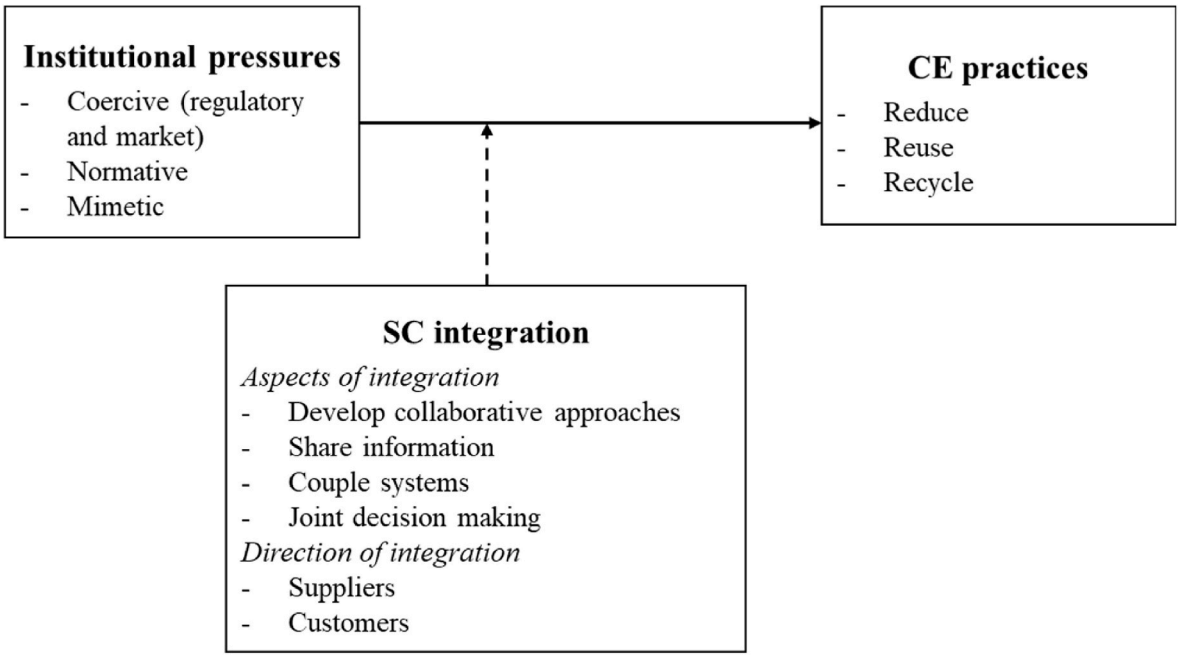

Fig. 1. The initial framework that facilitated discussions in the interviews.

The conceptual framework proposed by Calzolari et al. (2021) was centred around the idea that IPs are driving the adoption of CE practices, while higher levels of integration with suppliers and customers can magnify the effect of IPs on supply chains. However, this framework was developed using a mainly deductive process applied to the analysis of secondary data. Therefore, this paper aims to deepen and enhance the initial work of Calzolari et al. (2021) through the analysis of primary data, in order to address the following research questions.

- RQ1: How can institutional pressures drive the adoption of CE practices, and to what extent? Are certain types of pressures more relevant than others?
- RQ2: What role, if any, does supply chain integration play in the relationship between institutional pressures and the adoption of CE practices?

3. Method

In order to address the research questions, a qualitative approach was adopted (Fig. 2). This choice was related to the need for direct involvement of stakeholders in the investigation, given that the previous relevant studies have been mainly based on secondary data. Also, a qualitative approach is particularly suitable to the exploratory nature of the research questions as it can provide new knowledge on the relationship among these concepts.

In particular, a *Delphi-like* approach was employed, in order to elicit knowledge from a panel of qualified experts. Delphi studies allow access to experts' opinions in a structured manner and enable the ranking and prioritisation of key issues for management action (Okoli and Pawlowski, 2004; Schmidt et al., 2001). This study incorporates the key characteristics and aspects of a Delphi study, such as the structured selection of experts, the multi-round nature with multiple interactions, and the

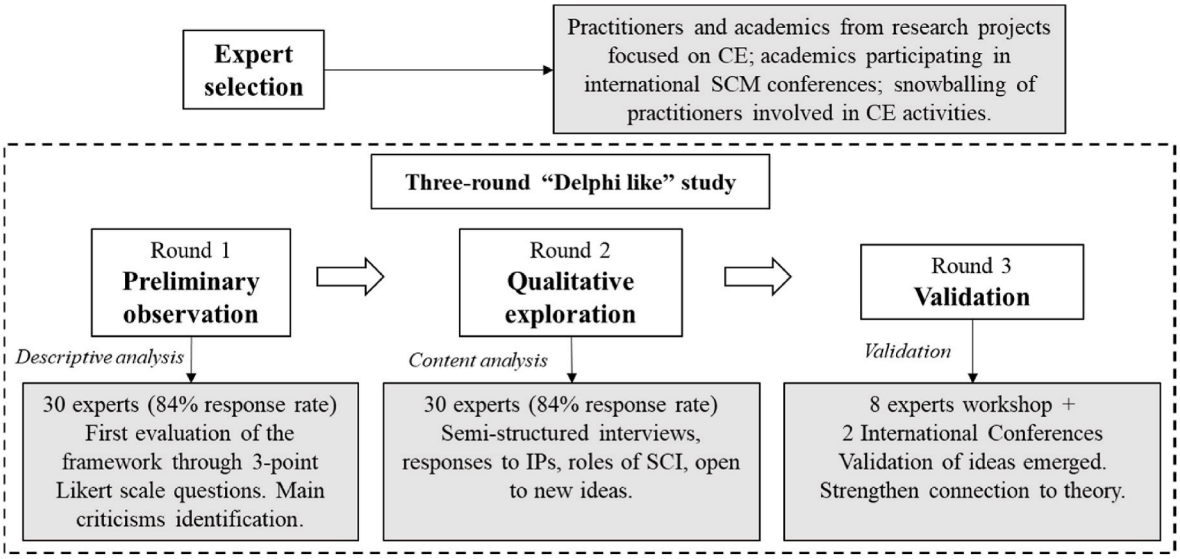

Fig. 2. Research method stages (adapted from De Lima and Seuring, 2023)

final validation stage through a workshop. Its objective is to gather and prioritise experts' opinions in order to fine-tune a conceptual framework (Okoli and Pawlowski, 2004). Group-wide discussions were organised where experts could provide feedback on the most common codes and emerging issues.

In the first subsection, we describe how data was collected through the different rounds of the Delphi-like study, and in the second one, the analysis process.

3.1. Design of the delphi-like study

We selected participants based on their knowledge of the research problem, whether it was theoretical or practical/managerial. All rounds of interviews were completed between February 2021 and February 2022. Most of the interviews were held online using the Google Meet platform, with only four taking place in person. The duration ranged from 30 min to 1 h and 30 min, with at least one interaction with each interviewee. In total, 30 international experts were interviewed in the study (see Appendix A for the full list). Where participants agreed, the interviews were recorded and were subsequently transcribed and analysed. Otherwise, notes were taken during the interview. An executive summary of the transcription was sent to each participant in order to validate our interpretation of the answers Saunders et al., 2023).

We used purposive sampling, adding a new interviewee until no new themes were emerging (Saunders, 2019). Participants from different backgrounds were chosen to avoid reaching saturation too early. In total, 12 participants from academia and 18 from industry were interviewed across the rounds in the Delphi-like study; detailed information about the participants' profiles is provided in Appendix A. As CE is a multi-disciplinary concept, academics had a wide range of expertise, with most having a SCM background, given the clear link of the phenomenon under investigation to CSCs. However, scholars from Strategic Management, Corporate Social Responsibility, Economics and Innovation were also involved. Practitioners came from diverse contexts, with representatives from both MNEs and SMEs invited, across many sectors such as manufacturing, agri-food, logistics, and services; for industrial participants, the level of engagement with CE principles of their organisation is also provided in Appendix A.

The research background and the variables involved were introduced to the participants before the interviews began. In the first round (R1), participants were invited to respond to some general statements regarding the relationships between existing variables (see Appendix B). Responses to statements were measured using a 3-point Likert scale (support, partially support, reject). Participants were also encouraged to briefly mention any other important aspects missing in the framework, provide criticisms, and suggest improvement points for the model. This initial phase allowed for the establishment of a first level of agreement on the relationships within the framework and generated a ranked list of the main criticisms.

In the second round (R2), the same research problem was explored through semi-structured interviews in a qualitative way. The objective of this phase was to uncover the nature of the relationships in the framework. Participants were asked to comment further on their agreement/disagreement points on R1 with anecdotal examples to demonstrate their points. Questions had a pre-established order and were open-ended, and participants were allowed to offer additional insights, altering the pre-determined flow of the questions (see Appendix B). New ideas were welcomed, and practical examples were incentivised. All the raised ideas and points were narrowed down again through content analysis, as explained in sub-section 3.2.

In the third round (R3), the final categorisation resulting from R2 was improved and validated. A workshop was organised with a total of eight experts (three practitioners and five academics, see Appendix A) to facilitate group-wide discussion and reach a final agreement. Experts helped evaluate the framework and suggested adding a third level of aggregation of concepts to link the different concepts that emerged to theory. A revised qualitative conceptual framework links the different points that emerged from R1 and R2. The results were also presented at two academic conferences, allowing for further validation.

3.2. Interview data analysis

A template analysis approach was employed (King and Brooks, 2017) to analyse transcribed interview data from the different rounds. A six-step approach (Fig. 3) was adopted, in line with previous qualitative studies (Rindova et al., 2011; Bressanelli et al., 2022; Wang et al., 2022). Interviews were first transcribed into textual data, and codes were then developed from such textual data using NVivo. As per template analysis guidelines, the approach was not entirely inductive, as some pre-defined themes were also used. Codes were initially assigned to existing *general* themes in the initial template (institutional pressures, supply chain integration and Circular Economy practices). This initial template was used as a starting point, with the objective of organising text, better visualising Empirical Observations (EO) associated with each of the *general* themes, and capturing the complexity of the qualitative information obtained from the interviews.

Through a clustering process, themes were further developed into more complex Conceptual Categories (CC, second-order themes) emerging from the Empirical Observations (EO). Initial themes and associated codes were grouped according to their similarity through an inductive process and assigned to one or more second-order themes. Second-order themes were then refined to avoid repetition. Finally, second-order themes were grouped into Aggregated Dimensions (AD, third-order themes), which highlighted how groups of Conceptual Categories are linked and relevant for the theory.

3.3. Final validation

Finally, the results of the content analysis were presented in a workshop in front of a panel of eight experts who provided feedback and helped improve the categorisation process and connect it with theory. In this phase, third-order themes were improved.

4. Findings

4.1. Preliminary observations: round 1

In the initial phase of the Delphi-like study, experts were asked some preliminary questions concerning the relationship among the identified constructs. The results of this process are reported in Fig. 4. In particular, 22 experts supported the idea that IPs are a major driver and include

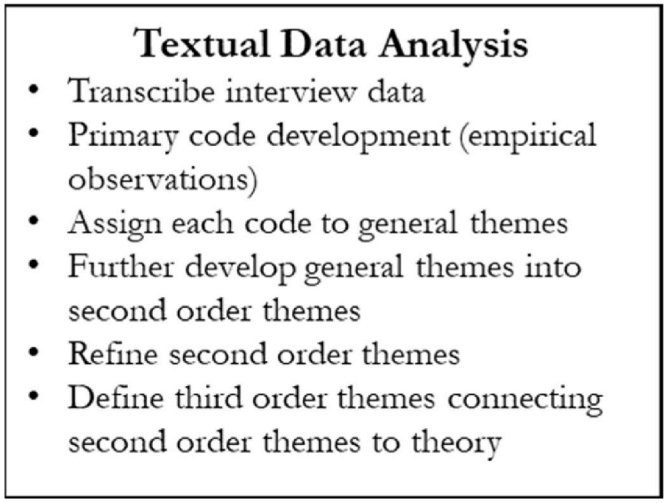

Fig. 3. Content analysis stages.

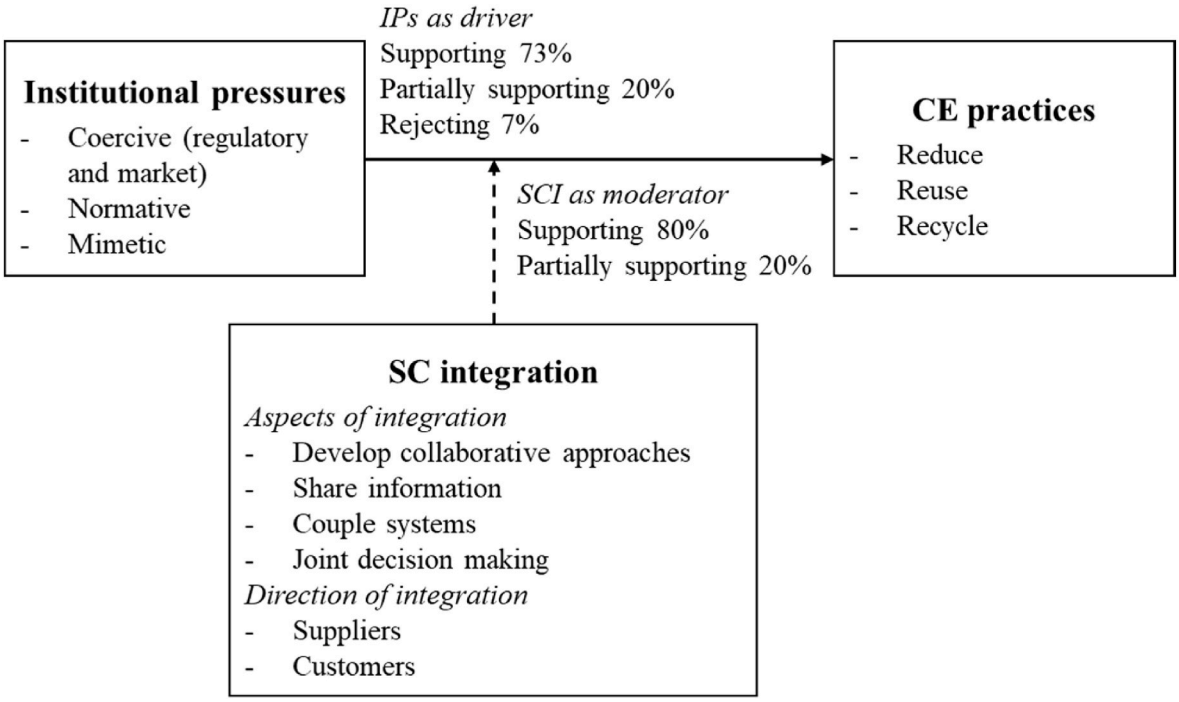

Fig. 4. Overview of the results.

most of the motivations behind the adoption of CE practices. Six of them partially supported this view, stating that there might be some other internal or external drivers to be considered. The remaining two expressed doubts about the assumption that there is a relationship between IPs and CE practices.

Twenty-four experts agreed that SCI should be viewed independently from pressures and that it has the capacity to influence the ability of a company to adopt CE practices. Six of them had a different view. Despite agreeing that SCI plays a key role, they claimed that there might be a relationship between IPs and SCI. Experts also identified further important aspects to be considered (Table 1).

4.2. Qualitative exploration: rounds 2 and 3

The results from the content analysis (R2) and of the following validation phase through workshops and conferences (R3) are presented together in this sub-section. R2 identified a hierarchy of pressures and four different ways through which pressures influence firms' behaviour, also shedding light on the complexities of the role of SCI in the relationship between pressures and adoption of CE practices (Table 2). During R3, group discussions with experts validated the themes that emerged in R2, improving individual experts' response quality, and identifying further points that will be discussed in the implications section.

Table 1
Main critiques to the initial framework.

Proposition	Critique	Frequency
IPs drive the adoption of CE practices	There are other internal drivers	6/30
	There are other external drivers	6/30
	There is no influence of institutional pressures on CE adoption	2/30
SCI is a moderator in that relationship	There is a relationship between IPs and SCI	2/30
	Adoption of CE has a feedback effect on SCI	2/30
Others	Focus on CE performance rather than adoption	2/30
	Need to distinguish between Disruptive vs Incremental CE	4/30
	Need to be aware of CE practices used for greenwashing	4/30

4.2.1. Institutional pressures – prescriptions, reactivity and the role of top management

Experts suggest the existence of a relationship between IPs and the adoption of CE practices (Fig. 4). Decisions about the implementation of CE practices strongly depend on prescriptions coming from the external environment, rather than on internal drivers, as highlighted by interviewees.

External pressures from different actors and sources influence firms' behaviour in many different ways (see Table 2, EOs from 1 to 16); some of the most relevant quotes are also shown according to the isomorphic mechanisms in Table 3, with pressures also clustered based on their effects and resulting behaviours. Four distinct types of responses were found, which describe different ways in which companies usually react to concurrent IPs (Table 2, from CC1 to CC4).

The first set of responses (Table 2, CC1) sees firms being pushed to *re-adjust their existing environmental monitoring systems* to address CE aspects. Firms might already have environmental management systems in place, and they might make use of environmental assessment tools to evaluate environmental impacts of their products, and present related actions and results in their sustainability reports. Pressures from academic research, policies, and consulting firms might drive a *re-adaptation* of these systems to make them fit for the CE. Examples include the definition of new KPIs for the progress towards CE (quote Q12a, Table 3) or the definition of new internal policies to make certain non-strategic processes more efficient and circular (quote Q12b, Table 3).

The second set of responses (Table 2, CC2) is concerned with the impact on firms' *new product development* processes. Some stakeholders, like NGOs and the civil society, through specific campaigns, might stimulate more radical types of innovations (quote Q22, Table 3) that go beyond simple greenwashing and tokenistic approaches, to support the adoption of more impactful R-imperatives (including attempts to *reduce* production volumes and incentivise *reuse*). At the same time, European legislation is pushing firms to be more ambitious and to conceive solutions for shorter material loops, rather than focusing on recycling of end-

Table 2
Data structure.

Code EO	Empirical observation (code)	Conceptual Categories (2nd order themes code CC#)	Aggregate dimensions (3rd order themes code AD#)
EO1	- Firms are starting to use environmental assessment tools (like LCA) to evaluate circular business models (CBMs) as a reaction to environmental research and consulting companies' advice	Re-adjusting existing environmental monitoring systems for the CE (CC1)	Efficiency oriented step-by-step approach to the CE (AD1)
EO2	- Firms are stressing CE principles in their Environmental Management Systems and in their Corporate Sustainability reporting as a reaction to consulting companies' advice and customers pressures		
EO3	- Publicly listed firms are using ESG measures and reporting on SDGs, sometimes including the contribution of CE practices		
EO4	- Professional categories are promoting new ideas/ concepts/strategies/tools within their organisations (e.g., architects, managers …)		
EO5	- Top Management of the most influential organisations have an influence on industry bodies guidelines that become widely accepted		
EO13	- CE used as a marketing strategy to reach new markets	Driving opportunistic behaviours and tokenistic actions (CC4)	
EO14	- CE is used to hide inaction reporting easy CE practices		
EO15	- Existing practices are rebranded as CE practices		
EO16	- Lobbying activities of leading companies are de-potentiating the CE concept at the policy level		
EO9	- New supply chain actors and intermediaries are emerging, which have the interest to disrupt business as usual	Re-organising operations and supply chain management (CC3)	Disruptive first-mover innovators approach to the CE (AD2)
EO10	- CSCs are expected to deliver other purposes (from delivering as fast as you can but closing the loop, create resiliency, depending less on primary resources)		
EO11	- European Commission is increasingly considering CE as a tool against resource scarcity - to keep resources in the system, and decrease the dependence from geographically (or geopolitically?) distant countries		
EO12	- Social norms influence employment, making environmentally engaged organisations more attractive		
EO6	- Policies are slowly shifting from recycling to "right-to-repair"	New products development (CC2)	
EO7	- Firms are learning from influential think-tanks that work on the CE (WBCSD, EMF)		
EO8	- Firm need to balance among different R-imperatives, and between short vs long term strategies through a risk-opportunity approach		
EO17	- Brand owners and consumers are setting the CE agenda	Market trends and consumers come first and build the pressure upstream in the supply chain. Regulation usually follows. (CC5)	Hierarchies of pressures and pathways of evolution (AD3)
EO18	- Customers are then asking for certifications upstream in the supply chain		
EO19	- Companies adopt CE practices because they want to look good to customers		
EO20	- Regulation requires immediate action	In absence of regulation voluntary action is weak or absent. After regulation is implemented, firms learn how to monetise the change in a cost-effective way. (CC6)	
EO21	- Policy pressures can be direct or indirect - act on different actors in the supply chain		
EO22	- Pressures from within the supply chain - power unbalance		
EO23	- Once firms start seeing the value of CE solutions, they share the benefits in the supply chain		
EO24	- Higher SCI can increase transparency/traceability/ visibility and sharing necessary information	SCI is an amplifier of incremental CE approaches (CC7)	SCI positively moderates the adoption of incremental CE practices and has both a positive and negative effect towards the adoption of disruptive CE practices (AD4)
EO25	- Enhancing the level of SCI can increase the strategic alignment of actors in the supply chain and create a shared responsibility	SCI interacts with institutional pressures, making it easier to extend pressures across supply chains (CC10)	
EO26	- Enhancing the level of SCI can align the purpose/priorities of different actors in the supply chain		SCI might positively mediate the relationship between some institutional pressures and the adoption of CE practices (AD6)
EO27	- Higher levels of SCI can help overcome structural multi-tier complexity and allow to better recognise pressures		
EO28	- Higher levels of SCI can help lower the uncertainties of returns and some operational challenges in circular supply chains		
EO29	- Enhancing the level of SCI can help winning the resistance to change of some actors in the supply chain	SCI is a necessary condition of disruptive CE approaches but not sufficient (CC8)	
EO30	- Higher levels of SCI can increase collaboration on new products development that integrate CE principles		
EO31	- Reusing materials requires visibility at all stages. Tools that are used today do not allow that		
EO32	- CE model implies you have to create strong partnerships, even outside traditional key suppliers and customers		
EO33	- Less dependency from suppliers is required to experiment with CBMs	SCI is an inhibitor of disruptive CE approaches (CC9)	SCI negatively moderates the adoption of disruptive CE (AD5)

(*continued on next page*)

Table 2 (*continued*)

Code EO	Empirical observation (code)	Conceptual Categories (2nd order themes code CC#)	Aggregate dimensions (3rd order themes code AD#)
EO34	- Higher levels of SCI can reinforce linear relationships, creating a lock-in against CE practices		
EO35	- Higher levels of SCI can reinforce incentives and purposes of the linear supply chain		

of-life products (quote Q20, Table 3).

The third set of responses (Table 2, CC3) is related to pressures that are driving firms to *re-organise their operations and supply chains*. Firms are pushed to create new links and feedback loops in their supply chains to make a better use of materials and reduce waste. The adoption of these practices can also help firms to reduce dependencies and enhance their resilience to external shocks (quote 10, Table 3). Experts include in this category also market pressures linked to the scarcity of some critical materials due, for instance, to geopolitical tensions. Legislators at the European level are aware of risks linked to the way supply chains are organised today and are actively promoting shorter and circular supply chains for critical components to secure future supply of critical materials.

The fourth set of responses (Table 2, CC4) includes resistance to change and the emergence of opportunistic behaviours and tokenistic actions: CE is interpreted as a temporary trend, which should be used to maximise sales and as a marketing strategy, to improve corporate image (quote Q6b, Table 3). Nevertheless, firms in sectors that are expected to be negatively affected by the transition might actively oppose it through lobbying activities (quote Q20, Table 3).

Interviewees explored not only sources and impacts of pressures but also provided insights on their strength and prominence (Table 2, EO 17 to 23). Coercive market and regulatory pressures seem to be the most important ones for two reasons. They are the ones that can modify firms' behaviour to a wider extent (Fig. 5a); also, the presence of these pressures seems to be a necessary condition for other pressures to emerge. In the absence of coercive pressures, experts suggest that firms would rarely engage in CE practices (see Q1b, Q5, Q21 Table 3) and normative and mimetic pressures would be extremely weak (quote Q11 and Q28, Table 3).

In order to support these points, experts shared their views on how different isomorphic pressures are related and influence each other, leading to the emergence of two evolution paths and hierarchies of pressures (AD3 and Fig. 5b). The first hierarchy identifies markets, trends, and consumers as the primary drivers for firms to adopt CE practices (CC5). Brand owners, taking into account consumer demand, face the most pressures and take ownership of driving these pressures upstream in the supply chain (quote Q3 Table 3). Within this hierarchy, coercive regulatory pressures typically follow coercive market pressures in terms of importance, followed by normative and mimetic pressures.

A second hierarchy of pressures identifies regulation as the most important and first pressure (CC6), stating that in the absence of regulation, firms' voluntary action is weak or absent (see quote Q1a in Table 3). Most companies would not consider developing more sustainable and circular products if societal pressures and legislation did not push them (see quotes Q2a in Table 3). After regulation is implemented, firms are forced to learn how to implement changes in a cost-effective way, again through coercive pressures of their suppliers and customers (quote Q2a in Table 3).

In both hierarchies, normative and mimetic pressures are less prominent. Mimetic pressures are still at their initial stage and are expected to become more important once some more firms have established new circularity standards and best practices in each sector (quote Q8 and Q9, Table 3). The emergence of these two alternative hierarchies is coherent to the plurality of views on the transition towards a CE: a first, more planned, regulation-driven, path, relying on legislation (path 1, Fig. 5b), and a market-driven one (path 2, Fig. 5b).

Experts also highlighted the risk of not considering other important drivers of the adoption of CE practices, both internal (such as top/senior management culture and commitment, organisational culture, and leadership) and external (such as national culture and resource scarcity – see quote Q10 in Table 3) to the organisation. Looking at the literature, some of these factors might be connected with IPs (Dubey et al., 2019). For example, experts suggested that there is a relationship between normative pressures and top management commitment (EO5, Table 3). This is because industry standards driving normative pressures are often defined by bodies that are clearly influenced by the top-management of the most important companies in the industry.

In the presence of pressures, organisations can respond in different ways. Some organisations might adapt to institutional requirements, while others might decide to resist them. The timing of action (quote Q11, Table 3) and the decision to be a first-mover or follower are crucial elements. Being a first-mover may have advantages, such as avoiding some pressures, but it may also require significant investments. Followers could benefit from a mimetic approach, imitating CE practices from peers. This insight may also suggest a link with top management commitment, which plays a role in determining companies' response to pressures.

It is worth mentioning that only two experts believed there are very weak pressures on companies to adopt CE practices. According to them, the current institutional norms should be analysed more in detail, given that the current dominant pressures are still pushing for supply chains that are designed according to a linear paradigm. Overall, however, the findings seem to validate the relationship between IPs and the adoption of CE practices (Fig. 4).

4.2.2. SCI – in support of the transition to the CE or in defence of linear supply chains?

Regarding the influence of SCI, most of the interviewed experts (24 out of 30) first supported its moderating role; however, SCI represents a multifaceted concept whose implications should be deeply investigated. Qualitative results provide contrasting evidence on the direction (positive-negative), the type of interaction (moderating-mediating[2]) and effect of SCI on the relationship between IPs and the adoption of CE practices, delivering a more uncertain characterisation of its role.

The first idea that emerges from the interviews is that SCI is a necessary condition and a prerequisite for successful CE implementation (CC7, Table 2). In summary, SCI activities describe the degree to which an organisation manages its supply chain to command, control, and manage the whole process. For 13 of the experts, SCI *positively moderates* the adoption of CE practices (see quotes Q13a and b, Q14, Q15b, Q17b in Table 4). In contexts with strong pressures, SCI amplifies their effect and plays a role in determining how deeply CE practices are adopted. On

[2] Mediating and moderating effects are concepts commonly used in statistical research analysis to understand the connections between variables and the underlying mechanisms that drive those connections (Hayes, 2013). The concept of mediating effect involves how one variable (known as the mediator) explains the relationship between two other variables (the independent variable and the dependent variable). The independent variable has a direct impact on the mediator, which then influences the dependent variable. On the other hand, the moderating effect refers to the influence of a third variable (moderator) on the strength or the direction of the relationship between an independent and a dependent variable.

Table 3
Example of relevant interview quotes – Institutional Pressures.

Time	EO (#)	Q (#)	Quotes	Source
Coercive Regulatory Pressures	EO20	Q1a	"The main reason companies adopt CE practices is to avoid sanctions […]. In absence of coercive pressures companies would not take action. You can see this from how different the actions of North American automotive companies are from the European ones, where there is presence of emission target reductions set by law"	Practitioner PH
		Q1b	"Compliance is the main driver for the Circular Economy. National directives that implement European Union guidelines and packages. But also national directives that provide incentives for green practices. Furthermore, companies want to be ready also for those directives that are not yet out there but might be in the pipeline. "	Practitioner PE
	EO16	Q20	"European Environmental Bureau calls for extending the right-to-repair directive to more electronic devices and criticised the powerful lobby of personal computers that made it possible to delay the application to that product"	Practitioner PE
	EO21, EO22	Q28	"The main pressures come either from legislation or from others in the supply chain. Usually it is the focal firm that spreads the pressures of the first tier suppliers and customers. I would expect mimetic pressures becoming stronger as a consequence of more firms having adopted CE practices"	Academic AA
Coercive Market Pressures	EO23	Q2a	The next step is about learning how to monetise the change in a cost-effective way. And operationalise the change in your supply chain in such a way that it makes business sense. At the moment, there are prejudices against the coercive side of the pressures – where coercive is just seen as an additional cost"	Practitioner PH
		Q2b	"Focal firms are pressuring others in the supply chain to share their level of inventory real time. Supra national regulation might bring pressures from within the supply chain."	Academic AA
	EO17	Q3	"You write the supply chain from left to right (extraction – manufacturer - distributor) but you have to read it right to left to understand how the transformation works: Brand owners (in this example manufacturers) and consumers are setting the CE agenda"	Practitioner PA
	EO02	Q12a	"To review the performance of our production process we have some KPIs around waste. Looking at the importance directives and our customers are giving to it we want to add KPIs on circularity of inputs"	Practitioner PC
		Q12b	"We are developing internal policies to make some processes more circular and less wasteful - for example making the use of reusable cups in cafeterias obligatory and making many processes paperless"	Practitioner PI
	EO17	Q21	"In some countries with different perception of social values, final consumers are not accepting fridges because a yellow ink in a label on the cardboard contains some cadmium. This obliges you to change the design of packaging and also of products at times"	Academic AB
Normative Pressures	EO12	Q4	"Social norms have an important effect on employment. Aspirations of improve environmental and makes of it a more attractive organisation"	Practitioner PC
	EO18	Q5	"A documentary from an NGO had a major impact on the industry, raising the problem of child labour. After that customers have started to ask for certifications, purify the sources of material"	Practitioner PQ
	EO4, EO19	Q6a	"Professional associations are evolving and driving CE (and green) practices. Think about architects that, through *design thinking* design buildings that can be easily recovered; or think about companies that have the knowledge to perform LCA about different product options"	Practitioner PF
		Q6b	"Our implementation of CE practices is at an initial stage. The primary need is to show our customers we are doing something and improve our corporate image"	Practitioner PM
	EO7	Q22	"NGOs, charities and communities are promoting collaborative and shared consumption models and truly innovative models that are able to overcome the dependence on fossil fuels, the concept of ownership and consumerism"	Academic AE
Mimetic Pressures	EO22	Q7	"The effect of peers influences the adoption of circular economy innovation; not specifically within supply chains but in general. It is also interesting to understand how different types of peers and firms have a different effect"	Academic AM
	EO7, EO8	Q8	"Companies use a risk and opportunity approach to study what that means for them - how it is going to impact the business - How it can create value for now and in the long term"	Practitioner PA
		Q9	"Companies monitor trends and might decide to follow them" the risk to be "cut out"	Practitioner PE
Other drivers	EO11	Q10	"Scarcity of resources is also a driver. For example scarcity of copper, which is a reality. With copper price going up linear business models are at risk. It is a very important driver for companies to explore the feasibility of other business models like circular ones."	Practitioner PP
Timing of action	EO8	Q11	"Companies need to decide whether to be a first mover or follower. Both strategies present advantages and risks. First movers could anticipate and avoid some pressures, like mimetic and coercive ones, which generally require an immediate (and maybe sub-optimal) reaction "	Academic AG

the other hand, the absence of SCI poses serious challenges in activating operational aspects related to material exchanges (quote Q13a Table 4). Also, academic experts mentioned this point and how the lack of adequate information sharing mechanisms and systems is one of the main barriers towards CE practices. A small number of experts expressed contrasting views on the exogenous nature of SCI and argued in favour of a *mediating* role (with IPs also driving SCI – see quote Q19 in Table 4). In line with this, content analysis unveils more evidence that SCI might have a direct relationship with IPs and have a more direct role in driving CE practices itself (CC10, Table 2). Enhancing the level of SCI, as a re-action to IPs, can provide a good platform for starting transformational processes, even in multi-tier and global supply chains (quote Q14 Table 4). Experts cited the cases of companies which are making good progress towards the development of closed-loop supply chains due to their ability to control their production and distribution networks (e.g., Apple and Michelin as notable cases). SCI is about developing key capabilities that are then useful to drive the adoption of CE practices themselves.

A second idea that emerges from the analysis process (CC8, Table 2) confirms the beneficial role of SCI aspects, but simultaneously highlights that being integrated with key suppliers and customers might not be sufficient to enable the adoption of some CE practices. SCI was originally conceptualised for intrinsically linear supply chains; as such, it is biased towards relationships with key suppliers and key customers and towards operational aspects, with no link with reverse and circular flows of materials and associated flows information (Bimpizas-Pinis et al., 2022). To them, SCI *could still positively moderate (or mediate)* the effect of pressures on the adoption of just incremental CE practices (e.g., recycle, recover, renewable energy and resource efficiency). However, the effect of SCI on more radical and disruptive approaches would be uncertain (quote 18a, Table 4).

The third idea that emerged (CC9, Table 2) is that, in some cases, SCI could *negatively moderate (or mediate)* the effect of pressures on the adoption of some more radical CE practices. In other words, more integrated supply chains could provide a form of lock-in into linear supply chains, being a barrier to adopt some approaches and a fully circular logic (see quote Q15a in Table 4). Hence, SCI might strengthen linear supply chains rather than stimulating new relationships with different actors, which have an interest in disrupting business as usual. This idea describes the tension between integration and CE practices in a context

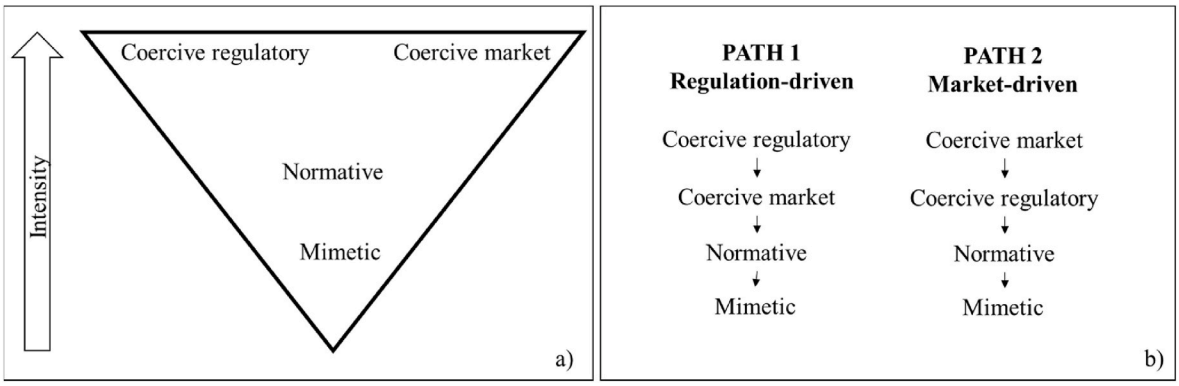

Fig. 5. Hierarchy of pressures (a) and evolution paths (b).

of well-consolidated linear supply chains. Established organisations are dealing with CE practices through a stepwise approach; however, lower dependence from suppliers might be required for the most disruptive transformations (Q17a, Table 4).

The need to be receptive to the external context is a key theme (Q9 in Table 3). Companies are aware that CE legislation could revolutionise markets and want to mitigate risks deriving from such potential changes (Q8 in Table 3). For this reason, it is necessary to adopt a learning approach from competitors and suppliers, in order to develop the most strategic partnerships and build the right knowledge. CE solutions can involve heavy initial technological investment; however, in many cases, they involve conceptual and social innovations and a different way to do things, to answer customers' needs and secure long-term growth within a context of legitimacy. Becoming more adaptable and reactive is considered a key capability in a context of change and might also be connected with the level of SCI.

Also, the adoption of CE practices could also have a feedback effect on SCI, favouring further integration; increasing levels of adoption and extension of CE practices might have a retro-active effect on information sharing and suppliers' involvement. Another notable insight was related to the SCI construct per se; one expert suggested that SCI was originally conceptualised for intrinsically linear supply chains; as such, there is no link with reverse and circular flows of materials and information. Consequently, the SCI concept might be revised in order to make it fully relevant to the transition towards a CE (Bimpizas-Pinis et al., 2022). Also, one expert warned against the dangers deriving from SCI and the potential resistances towards its achievement. More specifically, some companies might not be willing to share information that would be necessary to enable some CE process because of opportunistic behaviours of supply chain partners. A challenge that could be identified is how to share enough information without revealing too sensitive information at the same time.

IPs do not act with the same intensity for each organisation in a supply chain. Pressures influence primarily a certain organisation or a group of those. Organisations need to formulate a response to those pressures, which include involving their supply chain, transferring responsibilities, and delegating actions, verifying compliance with norms or codes of conduct, or even collaborating on the creation of solutions. SCI might also play a role on this and on how intensively a company is able to put the pressures in its own supply chain.

In synthesis, it is believed SCI could have both a moderating and a mediating role – acting on how intensely the supply chain as a system is able to perceive the pressures but also on extent it can react to them. However, this moderating role might be significantly less relevant, and possibly negative, when considering more radical CE practices.

4.2.3. CE practices in organisations and in their supply chains

Looking at the dependent variable of the framework, experts commented on how companies are approaching and implementing CE principles. They also highlighted some factors to be considered when assessing the process of adoption of CE practices in supply chains. Insights about this, and useful research implications were shared, along with hints on how to measure it, as reported in the following Table 6.

Practitioners pointed out the need to distinguish between very different supply chains and contexts and to analyse them through different approaches (quote Q27, Table 6). They also highlighted the importance of choosing wisely what CE outcomes are to be measured (quote Q23, Table 6), and of quantifying CE practices adoption across the whole company and supply chains (quote Q25, Table 6).

In order to assist with this, experts identified several control variables that can describe the type of market/industry. Companies may have varying behaviours and approaches to the implementation of CE, based on factors such as the intensity of investments in R&D, market concentration, and the type of customers they serve (whether they are businesses or final consumers). Additionally, the position in the supply chain might be a factor that influences the type of CE practices companies choose.

5. Implications

This section reflects on the findings that emerged in the results section. It formalises a qualitative framework, which is an evolution of the initial framework (Fig. 1). Results are also compared with recent literature, and theoretical and managerial contributions are highlighted.

5.1. An emerging qualitative framework: compliance versus proactive trajectories to the transition to a circular economy

Findings confirmed the relevance of the research problem and highlighted the need to investigate further and test the relationships in the initial framework (Fig. 1). The process shown in this paper culminated in a revised qualitative framework (Fig. 6), which combines the main ideas of the analysis (aggregated dimensions, shown in Table 2, from AD1 to AD6) in a comprehensive graph.

The framework (see Fig. 5) brings together the two different evolution paths of IPs, the four specific responses through which IPs are influencing firms' behaviour, the different ways through which SCI acts on pressures, and the relationship of the drivers with the type of CE practice being adopted. Specifically, the framework distinguishes two possible trajectories that could drive different CE outcomes, and which could be influenced in different ways by the level of SCI.

The first trajectory describes a regulation-driven path (CRP- > CMP- > NP- > MP, see Fig. 5), which refers to a context of weak regulation based on voluntary adoption that could be quite representative of the current situation in the European Union. In this scenario, firms decide to passively *comply* with environmental regulations, by re-adjusting their existing environmental monitoring systems, to measure their impact and by taking corrective actions. Firms adopt a step-by-step approach to the

Table 4
Example of relevant interview quotes – Supply Chain Integration.

Supply Chain Integration aspects	EO (#)	Q (#)	Quotes	Role in institutional pressures and CE relationship	Source
Sharing information	E24	Q13a	"Without sharing information it is impossible to adopt certain emission reduction or circular economy practices. Lack of information sharing is the first barrier."	*Positive*	Practitioner PH
		Q13b	"The complexity in the supply chain is a barrier to the implementation of the policies (e.g. REACH directive on chemical, ROAS directive on hazardous substances etc.). It is very difficult for firms to comply with them on one side and on the other side to demonstrate and have a clear picture if they are complying with them"	*Positive*	Academic AM
System coupling	E31	Q18a	"Reusing materials in the supply chain requires visibility at all supply chain stages. Digitalising information can be useful for guaranteeing that the material/products will be recovered"	*Positive*	Practitioner PN
		Q18b	"The role of digitalisation and new technologies is extremely important. Blockchain technology for example will bring great advantages to firms that want to implement CE practices in their supply chains"	*Positive*	Academic AD
Joint decision making	E25	Q14	"Taking decisions jointly with partners creates a shared responsibility adoption and make it easier to move towards a CE"	*Positive*	Academic AI
	E34	Q15a	"Linear supply chains that take decisions together could build cartels and resist to change"	*Negative*	Practitioner PD
	E29	Q15b	"Greater collaboration on improving processes and developing new products can help winning the resistance to change of some actors in the supply chain"	*Positive*	Practitioner PT
Collaborative approaches	E32	Q16	"Developing collaborative approaches is very important - CE model implies you have to create partnerships. Chemical companies are becoming partners with batteries users – to get those batteries back before the end of life with the recycler. Then you start to close the loop"	*Positive*	Practitioner PA
	E35	Q17a	"The more you collaborate and have aligned incentives with existing suppliers and customers mainly focusing on the forward supply chain, the more difficult it will be to activate new processes, adopt CE practices and challenge your linear business model."	*Negative*	Practitioner PD
		Q17b	"Long-term partnerships with suppliers support you in making sure your green practices are spread and bring a tangible improvement to your impact on the environment"	*Positive*	Academic AA
General supply chain integration	E28, 29, 30	Q19	"What matters most is that you want to change your level of SCI to get to the CE, you want to see the effect of that change, that comes from pressures on your sustainability performance in a CE"	*Positive*	Academic AH

CE, focusing only on very incremental CE practices that become institutionalised and create market pressures, normative pressures and memetic pressures. SCI is expected to have an amplifying role and driving role (Fig. 6). Key players, systems, and processes that are expected to drive the transition towards the CE in this case are the same involved in traditional linear supply chains. As such, they can take advantage of the collaborative capabilities of integrated supply chains to implement CE practices that are compatible with established linear value creation processes (e.g., mainly focused on the use of renewable energy, increase resource efficiency and with the integration of recycled flows). SCI could play a similar "amplifying" role also in the presence of tokenistic responses and opportunistic behaviours. Higher SCI could make it possible for key players of the linear supply chain to spread greenwashing actions and irresponsible practices, hiding their inertia (Ferns and Amaeshi, 2021).

The second trajectory describes a market-driven path (CMP- > CRP- > NP- > MP, see Fig. 5), with firms *proactively* adopting CE practices pushed primarily by consumer demand and public opinion. This path represents a context with a deeper societal and institutional transformation. New and stricter regulations are expected to emerge as a consequence of a push that comes from consumers, public opinion and societal demands. The most likely responses in this scenario involve reorganising supply chain operations and developing new products. Both these responses require new networks to emerge and disrupt markets by adopting Circular Business Models and more radical CE practices. Firms are also likely to establish new partnerships with new actors (e.g., collection and sorting contractors; re-processors; re-manufacturers). SCI in this case has a double role: it provides useful capabilities in terms of coordination and collaboration with key partners in the linear supply chain; however, it also magnifies the risk of lock-ins in linear supply chains. As such, companies with lower levels of SCI could have some advantages to succeed, deriving from a higher possibility to experiment with new solutions and decrease dependence on suppliers.

In line with previous studies, the framework shows that coercive IPs are the dominant ones (Agyabeng-Mensah et al., 2022) and a necessary condition to activate effective sustainability actions, and for the other pressures to originate (Arranz et al., 2022). Differently from previous literature, this study recognises paths and dynamics that experts are foreseeing. The study also points at the limitations of an institutional change that comes from regulation alone (Ranta et al., 2018). To build the necessary incentives for deeper societal transformation and stronger sustainability, it is necessary to redefine societal values and beliefs and deeply incorporating ecological instances in our institutions (Montabon et al., 2016).

Also, highlighting the double role of SCI is another key contribution of this article. The traditional debate on the collaborative paradigm in supply chain management (Frohlich and Westbrook, 2001) has explored SCI role in sustainability transitions (Wiengarten and Longoni, 2015), and it has started to look at CE transitions very recently (Bimpizas-Pinis et al., 2022). Results enrich the understanding of how SCI might affect the adoption of CE practices, by recognising its advantages and the possible risks. The central issue is how to leverage coordinative and collaborative aspects and capabilities of integrated supply chains without it becoming a constraint against radical innovation.

The responses to IPs that emerge from the qualitative analysis are in line with previous papers on sustainability trajectories (Silvestre et al., 2020). Also in this study, some of the identified initiatives or responses to pressures have an "exploitative" nature, being based on the supply chain capabilities that already exist (e.g., CC1 in Table 2: readjusting their existing environmental monitoring systems); some others have an "exploratory" nature, adopting completely new capabilities, products, processes, that are different from those used in the past (e.g., CC3 and CC2 in Table 2: re-organising their operations and supply chains and

developing new circular products). According to that perspective, SCI could be seen as a factor that provides necessary capabilities and alignment between supply chain actors while also increasing path dependency, pushing for initiatives that exploit existing sustainability process and practices rather than developing new ones. In the context of the transition towards the CE, higher path dependency could be associated to linear lock-in.

5.2. Contribution to theory

This paper extends previous research in sustainable supply chain management that has studied drivers, enabling factors, and practices using institutional theory (Kauppi and Luzzini, 2022). It is also connecting this knowledge and ideas to a more recent research field, circular supply chain management (Farooque et al., 2019; Lahane et al., 2020). This is important as it improves the theoretical understanding of the antecedents of the adoption of CE practices in supply chains by developing a conceptual framework that integrates IPs, supply chain integration, and the adoption of circular economy practices, which can be tested through future quantitative studies. Future empirical studies could then provide clarity on the hierarchy of pressures for the circular economy (e.g., whether mimetic and normative arise where coercive pressures are already present).

A second contribution is related to the concept of SCI. In particular, studying transitions towards a CE requires consideration of how supply chain structures and organisations are evolving. These supply chains might have developed specific capabilities and relationship links, which can provide an advantage, and at the same time, might contribute to creating conditions that foster change. Discussions with experts highlighted that more integrated structures might also have undesired effects. Also, they identified further important aspects and capabilities that might be key in supporting the evolution towards more sustainable production and consumption systems, such as agility and reduced dependence on suppliers and customers. Therefore, future research should consider the complex effect of SCI aspects on the relationship between the pressures a company faces and its behaviour, both a technological and relational point of view.

5.3. Contribution to practice

The findings presented in this paper also hold relevance for industrial practice. They stem from extensive interactions with a diverse group of practitioners, comprising the majority of the surveyed panel of experts. These professionals are actively involved in the day-to-day transformation of existing companies and possess significant experience in the field of CE. Results could offer both practitioners and policymakers a better understanding of how the external environment influences businesses to adopt CE practices. Policymakers can then incorporate these findings into the development process of regulatory guidelines or policy action plans. Companies can benefit from recognising different types of responses to IPs, as well as reflecting on how their level of SCI is going to affect the type of CE practice. The study also warns firms not to rely only on existing supply chain partners for implementing more radical CE practices, but rather to experiment further collaborations with potential new suppliers and customers.

Table 5
Possible measurement scales of CE outcomes.

CE practices aspects measured	Literature
R-imperatives	Reike et al. (2018)
Supply chain process involved	Gusmerotti et al. (2019)
Level of implementation	Calzolari et al. (2021)
Involvement the supply chain	
Sustainability performance (KPIs)*	(Jain et al., 2020) (Chiappetta Jabbour et al., 2020) Di Maria and De Marchi (2022)
Incremental vs radical tokenistic/greenwashing vs challenge linear consumption	(Arekrans et al., 2022) **from the interviews**

5.4. Insights for the operationalisation of constructs

Recent academic debate around IPs at the supply chain level has led to the development of more reliable scales to measure their constructs (Kauppi and Luzzini, 2022), which have overcome the limitations of previous approaches. In the CE literature, IPs have often been measured with proxies or bundled external pressure constructs (Gusmerotti et al., 2019).

The concept of SCI has been conceptualised in different ways. Some authors have distinguished between relational and technological integration constructs (Leuschner et al., 2013), while others have used the concept of arcs of integration to look at different aspects of integration (Frohlich and Westbrook, 2001; Schoenherr and Swink, 2012). These dimensions have been used and validated by the IMSS project in a number of empirical studies (Danese and Bortolotti, 2014; Wiengarten and Longoni, 2015).

Experts' perspectives were particularly useful in suggesting new dimensions to consider when measuring CE outcomes (see Recommendations R1 to R5, Table 6), in addition to those already used in recent literature (Table 5). CE practices were often classified by distinguishing among different R-imperatives (Reike et al., 2018; Lopes de Sousa Jabbour et al., 2019), the supply chain process involved (Dagiliene et al., 2020), the level of their implementation and the degree of involvement of supply chain partners (Calzolari et al., 2021), and the lifecycle phase involved (Elia et al., 2020). To ensure a critical evaluation of companies' claims and avoid greenwashing and reductionist approaches to CE (Recommendation R2, Table 6), some other dimensions were suggested. CE practices that enable incremental improvements of linear business models should be distinguished from radical innovations that promote sufficiency and enable the displacement of primary production (Recommendation R4, Table 6), as highlighted in recent literature (Arekrans et al., 2022). Experts also emphasised the importance of choosing wisely which CE outcomes to measure (R1, Table 6), and quantifying CE practices' adoption across the entire company and supply chain (Recommendations R2 and R3, Table 6).

6. Conclusions

This paper sheds some light on the relationship between IPs, supply chain integration and the adoption of Circular Economy practices. An initial framework, derived from academic literature and an analysis of corporate sustainability reports (presented in Calzolari et al., 2021), was challenged and refined through a consultation process with CE experts in a Delphi-like study. The analysis of the data collected through semi-structured interviews confirms the relationship among the identified concepts. Specifically, it validates that IPs drive the adoption of CE practices, wherein SCI plays a complex role in this dynamic relationship.

The paper suggests different ways in which IPs influence companies' behaviour when adopting CE practices. Practitioners and academic experts also reflected on the role of supply chain integration. The type of interaction with IPs (moderation or mediation) is contested. Also, some aspects of supply chain integration might reinforce supplier-buyer relationships in a linear perspective and become an obstacle for the most radical Circular Economy practices. The proposed qualitative framework also characterises two trajectories, which differ based on the type of reaction to pressures and the role played by supply chain integration.

The study contributes to the theory by improving the understanding of the process of adoption of Circular Economy practices also from a supply chain management perspective. From a practical standpoint, the evidence from this study could offer policymakers a better understanding of how the external environment influences businesses to adopt

Table 6
Issues to be considered when assessing the process of adoption of CE practices along with experts' recommendations.

Issue	Source	Recommendation	Detail
"The level of CE adoption is currently very low, on average, across industrial sectors. Most industries still work according to a linear logic and there is strong inertia towards change. Despite incumbents having some CE-inspired initiatives in place, they still have a strong reliance on energy-intensive, fossil fuel-based, consumeristic systems."	Practitioner	*Choose wisely what CE outcomes are to be measured (R1)*	Should we measure the adoption of some CE practices? Or, is it more important to focus on the sustainability performance in terms of some type of benefits they are expected to bring (e.g. environmental, economic and social)? This aspect is paramount and relates to the type of contribution studies want to achieve, and the debate they want to be part of. There is a dichotomy between the technical CE literature and the SCM literature. In the first case, the categorisation of different approaches could be more valuable; in the second one, the type of supply chain performance and outcome they can help to achieve could be of higher interest.
"Companies tend to use the CE label for existing practices, rebranding activities/practices they have already in place. Generally they do not aim at minimising resource extraction and their reliance on fossil fuels."	Academic	*Beware of greenwashing and tokenistic actions (R2)*	Researchers need to pay attention to greenwashing attempts: "circular" does not necessarily mean sustainable. For instance, fast fashion companies, while claiming to be *circular* (as they are incentivising recycling and take back schemes) are still relying heavily on fossil fuels and promoting irresponsible consumption patterns. This might be highlighting that the CE concept is being hijacked by the business community.
"Companies work on two parallel streams. On the one hand, they are experimenting with circular business models (trying them out in the market); on the other, they are still maintaining the linear ones as dominant."	Practitioner	*Quantify CE practices adoption across the whole companies and supply chains (R3)*	It is important to take into account to what extent CE practices are being implemented at a whole-company and whole-supply chain level. There should be awareness about tokenistic approaches to CE implementation.
"Companies most often focus on recycling, demonstrating a reductionist approach to CE, where higher R-imperatives (such as reduce and reuse) are not considered."	Practitioner	*Distinguish between incremental and transformative (and more disruptive) approaches (R4)*	It is important to distinguish between transformative approaches, where business models and ownership paradigms are deeply revisited, and those that have a focus just on increasing recycling, waste management and efficiency. Evidence of this could be found in the CE targets companies set, the type of organisation they collaborate with. Also, investments in R&D could help recognising these differences.
"The effect of the adoption of CE practices strongly depends on supply chain stages."	Practitioner	*Differentiate across contexts, sectors and stages in the supply chain (R5)*	Higher pressures are often placed on product manufacturers. Organisations operating upstream in the supply chain might face different challenges.

CE practices. Policymakers can then incorporate these findings into the development process of regulatory guidelines or policy action plans.

Future research could test the final framework through a large-scale data collection process. Also, another interesting avenue for further investigations is related to the role of IPs and supply chain integration in driving the adoption of more disruptive innovations in the transition towards a CE, along with the degree of circularity of resulting supply chains.

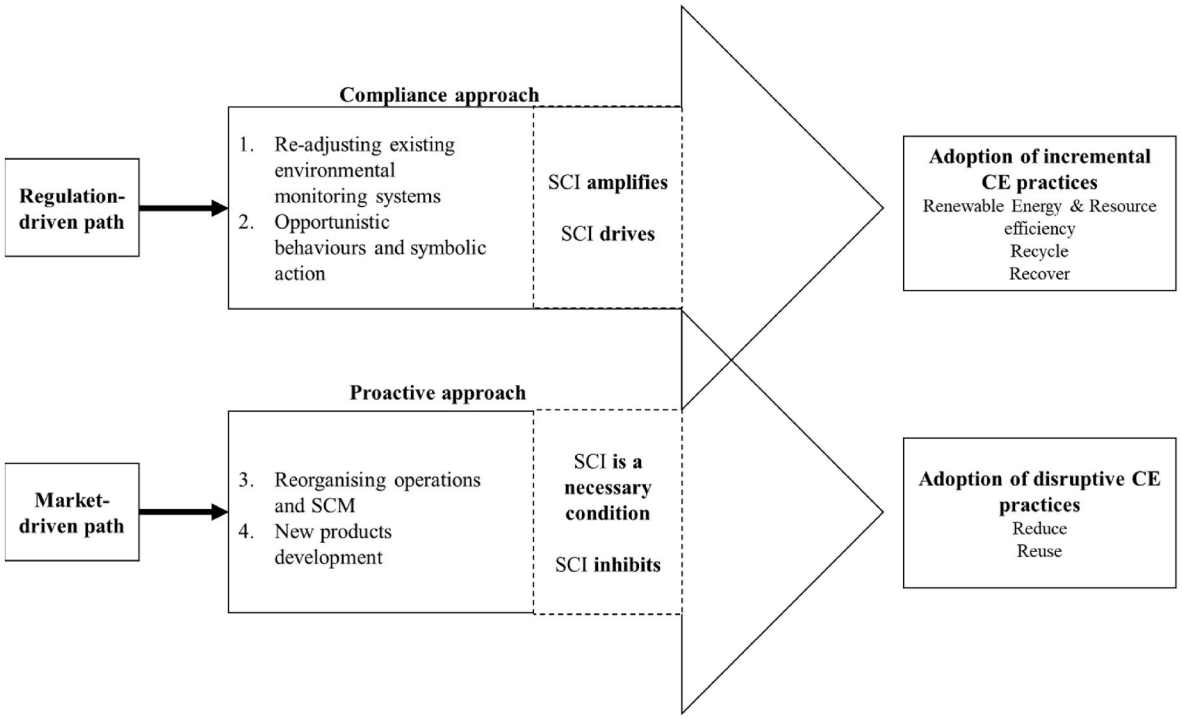

Fig. 6. A qualitative version of the framework.

Authors statement

All authors have contributed equally to the study, in terms of conceptualisation, methodology, data curation and writing. Tommaso Calzolari has been leading the data collection and analysis phases; Andrea Genovese has been in charge of funding acquisition for making this research possible.

Declaration of competing interest

Authors declare that there are no conflicts of interest related to this study.

Data availability

The data that has been used is confidential.

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Appendix A

Type	Interviewee code	Job Position	Industry/Discipline/Sector	Involvement with CE activities	Mode	Recorded	Duration
Round 1 & Round 2 (n=30)							
Practitioner	PA	Sustainability Manager	Chemical	The company is a leader in the CE	Online	No	1 h
Practitioner	PB	Operations Manager	Automotive	The company adopted some initial CE practices	Online	Yes	45 min
Practitioner	PC	Sustainability specialist	Material producer	The company is a leader in the CE	Online	No	1 h 30 min
Practitioner	PD	Sustainability Manager	Motors and Electronics	The company is a leader in the CE	Online	No	1 h
Practitioner	PE	CEO	Sustainability Consulting	The company is a leader in the CE	Online	No	1 h
Practitioner	PF	CEO	Think Tank	The company is a leader in the CE	Online	Yes	45 min
Practitioner	PG	Commercial Manager	Food	The company's business model is circular	Online	No	1 h
Practitioner	PH	Supply Chain Manager	Material producer	The company adopted some initial CE practices	Online	Yes	45 min
Practitioner	PI	Sustainability Manager	Energy provider	The company is a leader in the CE	Online	Yes	45 min
Practitioner	PL	Supply Chain Manager	IT Software company	The company adopted some initial CE practices	Online	Yes	45 min
Practitioner	PM	Supply Chain Manager	Logistics Provider	The company adopted some initial CE practices	Online	Yes	45 min
Practitioner	PN	Researcher and Consultant	Supply Chain Management	The company is a leader in the CE	Online	Yes	45 min
Practitioner	PO	Supply Chain Manager	Logistics Provider	The company adopted some initial CE practices	Online	No	45 min
Practitioner	PP	Product Manager	Industrial Equipment Components	The company adopted some initial CE practices	Online	No	45 min
Practitioner	PQ	Supply Chain Manager	Food production company	The company adopted some initial CE practices	Online	No	45 min
Practitioner	PR	Researcher	Policy Think-Tank	The company is a leader in the CE	Online	No	45 min
Practitioner	PS	Managing Director	Recovery of cooking oil	The company's business model is circular	In person	No	45 min
Practitioner	PT	Sales & Marketing Director	Distribution of food	The company adopted some initial CE practices	In person	No	45 min
Academic	AA	Lecturer	Supply Chain Management	CE is part of the research interests	Online	No	45 min
Academic	AB	Professor - Practitioner	Operations Management	CE is part of the research interests	Online	Yes	1 h
Academic	AC	Associate Professor	Strategy and Corporate Responsibility	CE is one of the main research interests	Online	No	1 h
Academic	AD	Professor	Supply Chain Management	CE is one of the main research interests	Online	Yes	1 h
Academic	AE	Professor	Supply Chain Management	CE is one of the main research interests	Online	No	45 min
Academic	AF	Professor	Innovation studies	CE is part of the research interests	In person	Yes	1 h
Academic	AG	Professor	Supply Chain Management	CE is part of the research interests	Online	No	30 min
Academic	AH	Professor	Supply Chain Management	CE is part of the research interests	Online	Yes	1 h
Academic	AI	Professor	Supply Chain Management	CE is part of the research interests	Online	No	45 min
Academic	AL	Conference	Sustainable management	CE was part of the topics of the conference	In person	Yes	25 min
Academic	AM	Conference	Economics and Innovation	CE was part of the topics of the conference	Online	Yes	25 min
Academic	AN	Professor	Innovation	CE is one of the main research interests	Online	Yes	30 min
Total							24 h 20min
Round 3 (N=8)							
Practitioner	PU	Sustainability Specialist	Government Environmental Agency	This agency works on the CE	Workshop In person	/	1 h

(*continued on next page*)

(*continued*)

Type	Interviewee code	Job Position	Industry/Discipline/Sector	Involvement with CE activities	Mode	Recorded	Duration
Practitioner	PV	Sustainability Specialist	Government Environmental Agency	This agency works on the CE			
Practitioner	PZ	Programme Manager	Non-Governmental Organisation	The NGO is a leader in the CE			
Academic	AC	Associate Professor	Strategy and Corporate Responsibility	CE is part of the research interests			
Academic	AN	Professor	Supply Chain Management	CE is part of the research interests			
Academic	AO	Researcher	Supply Chain Management	CE is one of the main research interests			
Academic	AP	Professor	Supply Chain Management	CE is part of the research interests			
Academic	AQ	Researcher	Circular Economy	CE is one of the main research interests			

Appendix B

Interview questions.
Round 1 – *Preliminary observation.*

I. Do you think there is a relationship between institutional pressures and the adoption of circular economy practices? *(support, partially support, reject)*
II. Do you support/reject the existence of a relationship between supply chain integration and the relationship between institutional pressures and the adoption of circular economy practices? *(support, partially support, reject)*
III. Do you see any challenge/improvement point? *(briefly mention them)*

Round 2 – *Qualitative exploration.*

I. Details and anecdotes to support/reject the existence of a relationship between institutional pressures and the adoption of circular economy practices:
   - *How do you think coercive market pressures affect the adoption of circular economy practices?*
   - *How do you think coercive regulatory pressures affect the adoption of circular economy practices?*
   - *How do you think normative pressures affect the adoption of circular economy practices?*
   - *How do you think mimetic pressures affect the adoption of circular economy practices?*
II. Details and anecdotes support/reject the existence of a relationship between supply chain integration and the relationship between institutional pressures and the adoption of circular economy practices.
   - *How do you think sharing information with suppliers and customers can affect the relationship between institutional pressures and the adoption of circular economy practices?*
   - *How do you think coupling systems with suppliers and customers can affect the relationship between institutional pressures and the adoption of circular economy practices?*
   - *How do you think collaborative approaches with suppliers and customers can affect the relationship between institutional pressures and the adoption of circular economy practices?*
   - *How do you think joint decision making with suppliers and customers can affect the relationship between institutional pressures and the adoption of circular economy practices?*
III. Can you elaborate on the following challenges/criticisms to the framework emerging from Round 1?
   - *Existence of other internal drivers to the adoption of circular economy practices*
   - *Existence of other external drivers to the adoption of circular economy practices*
   - *Institutional pressures have no influence on the adoption of circular economy practices*
   - *There is a relationship between Institutional pressures and supply chain integration*
   - *Adoption of circular economy practices has a feedback effect on supply chain integration*
   - *Focus on circular economy performance rather than adoption*
   - *Need to distinguish between Disruptive vs Incremental circular economy practices*
   - *Need to be aware of circular economy practices used for greenwashing*
IV. Do you want to add any additional insights?

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