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# Moving toward a circular economy in manufacturing organizations: the role of circular stakeholder engagement practices

Lea Fobbe
*Department of Industrial Management, Industrial Design and Mechanical Engineering, University of Gävle, Gävle, Sweden, and*
Per Hilletofth
*Department of Industrial Management, Industrial Design and Mechanical Engineering, University of Gävle, Gävle, Sweden and*
*Department of Product Development, Production and Design, School of Engineering, Jönköping University, Jönköping, Sweden*

## Abstract

**Purpose** – The circular economy (CE) approach has been acknowledged as key for manufacturing organizations wishing to overcome sustainability challenges. However, the transition has been slow. Stakeholder engagement is a driver of the transition, but there is limited knowledge on stakeholder engagement practices in a CE context. The purpose of this paper is thus to explore with whom, on what and how organizations engage with stakeholders to implement CE as part of sustainability efforts.

**Design/methodology/approach** – This study is situated at the intersection of CE, stakeholder theory and supply chain literature. A case study with three Swedish manufacturing organizations was conducted to explore stakeholder engagement practices that facilitate the implementation of CE in organizational practice and the supply chain, considering conceptual differences between stakeholder engagement for sustainability and CE.

**Findings** – This study provides empirical evidence on how manufacturing organizations engage stakeholders to implement CE as part of organizations' sustainability efforts. The study highlights that manufacturing organizations have to move not only from linear to circular resource flows, but also from linear to circular stakeholder engagement. Such engagement can be achieved by extending with whom, expanding on what and leveling up how stakeholders are engaged.

**Originality/value** – This study provides an enhanced conceptual understanding of stakeholder engagement in the CE context and discusses differences regarding stakeholder engagement based on linear thinking. The study emphasizes the role of circular stakeholder engagement practices for the transition toward CE in manufacturing organizations.

**Keywords** Circular economy, Stakeholder theory, Supply chain management, Sustainability, Manufacturing organizations

**Paper type** Research paper

## 1. Introduction

Circular economy (CE) is an umbrella concept that describes a regenerative economic system in which material and energy input and waste and pollution outputs are minimized, while securing continuous development of the economy (Geissdoerfer *et al.*, 2017; Kirchherr *et al.*, 2017). CE has been recognized as a key approach to sustainable development through

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countering the currently dominant linear source-manufacture-sell-use-dispose economic system (Ellen MacArthur Foundation, 2022; Ghisellini *et al.*, 2016). However, despite the growing promotion of CE by international institutions, academia and society, less than 9% of the global economy is circular (Circle Economy, 2020).

To enable a widespread transition from linear to circular resource flows, the manufacturing sector plays an important role, due to its impact on the global economy, society and the environment (Bjørnbet *et al.*, 2021; Blomsma *et al.*, 2019; Jaeger and Upadhyay, 2020). An increasing number of studies highlight the benefits and opportunities of CE for manufacturing organizations (Aloini *et al.*, 2020; Kumar *et al.*, 2019), but most manufacturing organizations are still inexperienced in this context and fail to translate CE principles into their organizational practices, such as their supply chain management (SCM) (Jaeger and Upadhyay, 2020; Lieder and Rashid, 2016).

SCM that integrates CE principles, also called circular supply chain management (CSCM), can help to reduce the consumption of resources and energy throughout the supply chain and minimize waste by reusing, remanufacturing and recycling, instead of disposing of material (Geissdoerfer *et al.*, 2018; Kumar *et al.*, 2019). Stakeholder engagement has been recognized as a key factor for enabling the transition to such circular resource flows (Calicchio Berardi and Peregrino de Brito, 2021; Mishra *et al.*, 2019; Zhang *et al.*, 2021), and the lack of it as one of the biggest barriers to CE implementation (Farooque *et al.*, 2019a; Vermunt *et al.*, 2019). Stakeholder engagement builds on stakeholder theory and is an integrative framework encompassing the management of stakeholder needs, interaction with them, as well as learning from them (Freeman *et al.*, 2017).

Stakeholder theory has frequently been applied in the sustainability literature (Hörisch *et al.*, 2014; Samant and Sangle, 2016). It has also been recognized as crucial for expanding the conceptual understanding of how to implement CE in an organization's practices and supply chain (Allen *et al.*, 2021; Baah *et al.*, 2022; Shah and Bookbinder, 2022). However, CE research has mainly applied a resource-based and institutional theory perspective, while the link between CE and stakeholder theory has not yet been fully investigated (De Angelis, 2021; Lahane *et al.*, 2020). Previous research has mainly focused on specific elements of stakeholder engagement, such as managing stakeholder pressure to implement CE (Jakhar *et al.*, 2019; Pinheiro *et al.*, 2022) and understanding stakeholder influence for developing CE strategies (Govindan and Hasanagic, 2018; Marjamaa *et al.*, 2021; Wang *et al.*, 2022).

Only a limited number of studies have considered stakeholder engagement from an overarching perspective for implementing CE (Bertassini *et al.*, 2021; Salvioni and Almici, 2020; Tapaninaho and Heikkinen, 2022). In addition, Allen *et al.* (2021) argue that the slow transformation toward CE may be explained by research using approaches based on linear thinking without adequately addressing conceptual differences. Scholars (Allen *et al.*, 2021; Chiappetta Jabbour *et al.*, 2019; Farooque *et al.*, 2019b), therefore, call for a better understanding of stakeholder engagement in CE context and how it can be approached to facilitate the shift from linear to circular resource flows. This paper aims to fill these research gaps by exploring with whom, on what and how manufacturing organizations engage with stakeholders to implement CE from an overarching perspective. This paper thus contributes to the current literature on CE by providing a better conceptual understanding of stakeholder engagement in the CE context.

Drawing on case studies of three Swedish manufacturing organizations, this paper proposes a circular stakeholder engagement approach that can support manufacturing organizations in implementing CE in their organizational practices and supply chain. Hence, this paper offers useful insights for theory and practice by highlighting the role of circular stakeholder engagement practices for the transition toward CE in manufacturing organizations.

The remainder of the paper is structured as follows: a background on CE and stakeholders in the CE context, as well as an introduction to stakeholder engagement in SCM literature is provided in Section 2. Section 3 explains the research methods used in this study. Section 4 presents the results and Section 5 discusses the results. The last section provides conclusions and future research directions.

## 2. Literature review

### *2.1 Circular economy and manufacturing organizations*

The concept of CE focuses on optimizing resource usage and minimizing production waste, through transforming linear source-manufacture-sell-use-dispose resource flows into circular resource flows (Ellen MacArthur Foundation, 2022; Ghisellini *et al.*, 2016). The aim is to change production and consumption patterns with approaches such as maintaining and reducing, reusing, remanufacturing and recycling products and material (Figure 1) (De Angelis *et al.*, 2018; EC, 2022a; Kirchherr *et al.*, 2017). Thus, CE has been recognized as a key approach to sustainable development, even though the relationship and potential differences between CE and sustainability and how organizations can approach these concepts, have not yet been fully investigated (Geissdoerfer *et al.*, 2017; Pieroni *et al.*, 2019; Stewart and Niero, 2018).

CE has been perceived as a beneficial approach, together with other organizational sustainability initiatives, or as a condition for sustainability, but also as a trade-off with sustainability efforts, highlighting that the conceptual and theoretical consolidation of CE needs further exploration (Allen *et al.*, 2021; Bjørnbet *et al.*, 2021; Geissdoerfer *et al.*, 2017). Similarly, Chiappetta Jabbour *et al.* (2020) argue that the theoretical and conceptual link between CE and stakeholder theory is established through the existing connections between stakeholder theory and organizational sustainability concepts such as Corporate Social Responsibility (CSR) and sustainable supply chain management (SSCM). On the other hand, Allen *et al.* (2021) highlight the need for further understanding the linkage between CE and stakeholder theory. An increasing number of scholars have, therefore, developed frameworks, strategies and processes for how organizations can implement CE in their

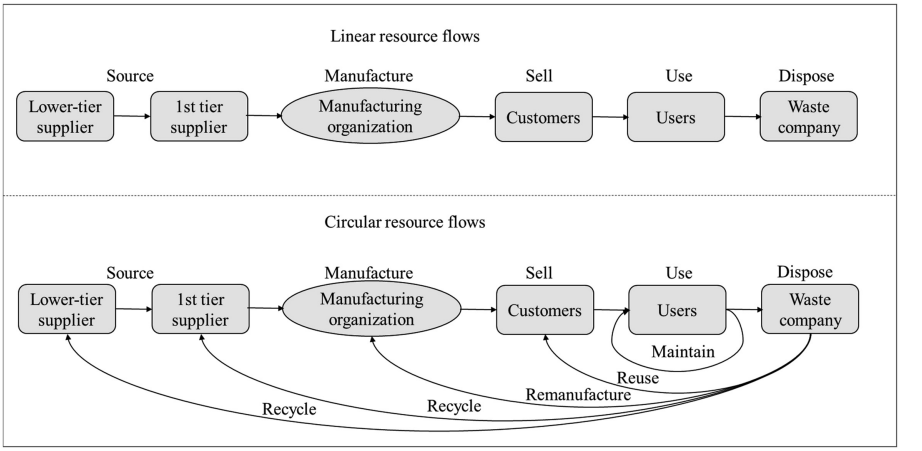



**Figure 1.**
From linear to circular resource flows

**Source(s):** De Angelis *et al.* (2018), EC (2022a), Kirchherr *et al.* (2017)

organizational practices and supply chain (Blomsma *et al.*, 2019; Calicchio Berardi and Peregrino de Brito, 2021; Frishammar and Parida, 2019).

To initiate a transition to CE, organizations need to focus first on their internal sustainability approach, such as establishing a clear vision and strategies for sustainability and CE, as well as a stakeholder engagement approach (Bertassini *et al.*, 2021; Bocken *et al.*, 2018; Frishammar and Parida, 2019). This includes identifying sustainability problems, learning and creating an awareness of CE principles and identifying and analyzing relevant stakeholders and their needs when starting the transition process (Bertassini *et al.*, 2021; Blomsma *et al.*, 2019; Salvioni and Almici, 2020). However, little is known about how stakeholder engagement may be approached from an overarching perspective to implement CE as part of the sustainability efforts (Bertassini *et al.*, 2021;Farooque *et al.*, 2019b; Rincón-Moreno *et al.*, 2021).

### *2.2 Stakeholder engagement in the context of CE*

Stakeholder engagement represents a key concept in stakeholder theory (Freeman *et al.*, 2017) and is one of the most commonly used approaches in sustainability and business research. The theory states that to ensure survival, organizations need to consider stakeholders in their value-generation processes (Chang *et al.*, 2017; Freeman, 2010; Hörisch *et al.*, 2014). A stakeholder, from this perspective, has been defined as any individual, group or organization that affects or is affected by organizational activities (Freeman, 1984). Stakeholders are often categorized as internal (employees and management) and external (suppliers, customers, government and NGOs) (Bryson, 2004; Freeman, 2010). As this categorization does not necessarily allow for a CE perspective, Bertassini *et al.* (2021) recommend differentiating stakeholders as internal, value chain and value network. While value chain stakeholders are directly affected by, or affect an organization's activities (for example suppliers, customers, users), value network stakeholders are affected by or affect an organization's performance, but not their direct activities (such as governmental institutions, competitors, academia, NGOs and local communities) (Bertassini *et al.*, 2021).

Stakeholder engagement describes all practices an organization undertakes to identify relevant stakeholders and manage their needs, establish different interaction approaches and create learning processes from and with stakeholders through education and training (Freeman *et al.*, 2017; Greenwood, 2007). Based on a literature review, Samant and Sangle (2016) show that the perspective in the organizational sustainability literature on stakeholder engagement changed over the last few decades from stakeholders being perceived as value inhibitors to being perceived as enabling value co-creation. Within the CE literature, stakeholder engagement has been found crucial to implementing CE practices, as it can help to align interests, create a shared vision and build relationships based on trust that allow the sharing of knowledge and information (Bertassini *et al.*, 2021; Calicchio Berardi and Peregrino de Brito, 2021; Salvioni and Almici, 2020). In addition, stakeholder engagement can enable sharing of risk, better access to resources, co-constructing knowledge for political decision-making and developing the industry (Fadeeva, 2005; Jakhar *et al.*, 2019; Tapaninaho and Heikkinen, 2022). Thus, stakeholder engagement has been recognized as a valuable lens to enable a successful implementation of CE (Baah *et al.*, 2022; Govindan and Hasanagic, 2018; Gupta *et al.*, 2019). However, organizations may also face a number of barriers related to stakeholder engagement, hindering the implementation of CE within their organizational practices and along the supply chain (Farooque *et al.*, 2019a; Vermunt *et al.*, 2019).

A number of scholars (Kumar *et al.*, 2019; Santa-Maria *et al.*, 2021; Tura *et al.*, 2019) have discussed barriers within an organization, such as a lack of expertise on the topic, lack of management commitment and conflicts of interest and values between different geographic operation locations. For example, Hofmann and Jaeger-Erben (2020) argue that CE

transformations are often only discussed by the sustainability and management department, while other functional areas such as operations and logistics are not involved. At the supply chain level, barriers such as a lack of knowledge along the supply chain on product design and production, lack of suitable partners and customer disinterest, as well as a lack of supply chain coordination and interaction with suppliers and customers, have been found (Jaeger and Upadhyay, 2020; Masi *et al.*, 2018; Vermunt *et al.*, 2019). For example, organizations that sell products to end users may exclude manufacturing organizations from after-sale and after-use product phases (Guldmann and Huulgaard, 2020; Hofmann and Jaeger-Erben, 2020; Tura *et al.*, 2019). In addition, the recycling behavior of consumers affects potential CE practices (Vermunt *et al.*, 2019). This not only underscores the important role of stakeholder engagement for circumventing these barriers, it also shows the need for more research into how stakeholder engagement may be approached to enable the implementation of CE within organizational practices and along the supply chain (Baah *et al.*, 2022; Wang *et al.*, 2022). Supply chains and their management encompass, by definition, the engagement of various stakeholders. Stakeholder engagement, therefore, plays an important role in the SCM literature that aims to integrate CE principles (Farooque *et al.*, 2019b; Govindan and Hasanagic, 2018).

### *2.3 Circular supply chain management*

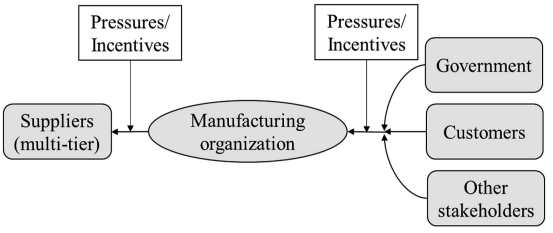
CSCM describes the integration of CE principles into the management of the supply chain as well as its surrounding industrial and natural ecosystems, aiming to shape resource flows into circular models within and across supply chains (Farooque *et al.*, 2019b). The concept is aligned with and builds on other concepts in the SCM literature, such as SSCM (Farooque *et al.*, 2019a; Govindan and Hasanagic, 2018). Despite both SSCM and CSCM being concerned with material and resource flows along supply chains, SSCM is based on linear thinking aiming to reduce material input and waste outputs to contribute to sustainable development, whereas CSCM aims to achieve a zero-waste economy through establishing restorative and regenerative cycles based on circular thinking (Farooque *et al.*, 2019b; Genovese *et al.*, 2017). CSCM encompasses multiple SCM approaches such as closed loop, reverse, remanufacturing and recycling SCM, as well as industrial symbiosis, but extends their boundaries (Zhang *et al.*, 2021). Thus, CSCM requires new approaches on how to structure a supply chain, as well as on how to engage stakeholders to move toward circular flows (Calicchio Berardi and Peregrino de Brito, 2021; Farooque *et al.*, 2019b). However, while there is a large body of literature that has applied stakeholder theory in SCM and SSCM, conceptual similarities and differences of applying stakeholder theory to move toward CE have not yet been fully explored (Allen *et al.*, 2021; Chiappetta Jabbour *et al.*, 2020).

Stakeholder engagement in traditional SCM focused predominantly on the linear exchange of material and resources with customers and suppliers to enable an effective supply chain (Mentzer *et al.*, 2001; Stadtler, 2008). A number of scholars have discussed the influence of stakeholders on supply chain sustainability as well as interaction with stakeholders, in order to strengthen sustainability performance (Gimenez and Tachizawa, 2012; Seuring and Müller, 2008; Vachon and Klassen, 2008). For example, Seuring and Müller (2008, p. 1700) refer to the "cooperation among companies along the supply chain" when defining SSCM. In particular, the SSCM literature considers customers, suppliers and governments and how they influence sustainability implementation in supply chains through various pressures and incentives (Meixell and Luoma, 2015; Seuring and Müller, 2008). Wilhelm *et al.* (2016) found that manufacturing organizations that are first-tier suppliers increasingly face a double agency role of having to fulfill their customer sustainability requirements and at the same time oversee the implementation of sustainability in their suppliers' operations, thus indicating a linear engagement approach (Figure 2). Stakeholder

engagement with stakeholders outside the direct supply chain, such as NGOs, local community, competitors and the media to implement SSCM are, even though increasingly in the focus, not commonly considered (Carmagnac, 2021; Chen *et al.*, 2017; Meixell and Luoma, 2015). Other stakeholders, such as academia, external consultants and complementary innovators, are infrequently considered in the supply chain literature, according to a literature review from Meixell and Luoma (2015).

Previous CE research has mainly focused on managing stakeholder interest for CE implementation and analyzing the effect of stakeholder pressure on the process (Jakhar *et al.*, 2019; Marjamaa *et al.*, 2021; Pinheiro *et al.*, 2022). For example, Marjamaa *et al.* (2021) analyze stakeholder interest in CE, highlighting that stakeholders are active in shaping practices for CE. Wang *et al.* (2022) identified consumers, governments and industry leaders as the most relevant stakeholders when it comes to overcoming barriers related to circular product design, followed by suppliers, competitors and local communities. However, collaboration with stakeholders beyond the immediate supply chain, such as competitors, remains still rare. Other stakeholders such as educational institutions, media and NGOs were found to be less influential (Wang *et al.*, 2022). This is in line with other studies showing that mainly governmental, supply chain stakeholders and employees encourage organizations to start working with CE and implement it in their supply chain (Baah *et al.*, 2022; Govindan and Hasanagic, 2018).

CE scholars (Pieroni *et al.*, 2019; Urbinati *et al.*, 2020; Vermunt *et al.*, 2019), therefore, advocate proactively involving employees and both up- and downstream stakeholders, so as to enable circular supply chain configuration. This includes promoting employee and management awareness to foster high-level commitment, as well as training and certifying external stakeholders along the whole supply chain on issues such as recycling to develop a shared CE understanding (Del Giudice *et al.*, 2020; Mishra *et al.*, 2019; Torres-Guevara *et al.*, 2021). A study by Zhang *et al.* (2021) showed that manufacturing organizations mainly interact with stakeholders to innovate business models and processes, such as integrating modularity in product design and to establish reverse logistics with the aim of developing effective collection, reprocessing and redistribution channels. These kinds of stakeholder engagements are often established vertically along the direct supply chain with for example material suppliers (Zhang *et al.*, 2021). Only a few studies have analyzed interaction approaches with stakeholders at the end of the value chain, such as users and waste companies, or in the value network such as academia (Ki *et al.*, 2020; Mishra *et al.*, 2019; Shah and Bookbinder, 2022). Thus, while stakeholder engagement has been recognized as a key factor for enabling the transition to CE (Calicchio Berardi and Peregrino de Brito, 2021; Mishra *et al.*, 2019; Zhang *et al.*, 2021), there is a lack of conceptual understanding on how stakeholder engagement may be approached from an overarching perspective encompassing relevant stakeholders, focus and the engagement approach, as well as how this may differ from other SCM literature streams (Allen *et al.*, 2021).




**Source(s):** Adapted from Seuring and Müller (2008)

**Figure 2.**
Stakeholder pressures and incentives within SSCM

## 3. Research methods

To explore how manufacturing organizations engage with stakeholders when implementing CE as part of their sustainability efforts, a multiple case study approach was adopted. Case study research enables investigating real-life and complex phenomena in depth, revealing rich information and underlying relationships of the analyzed phenomenon (Saunders *et al.*, 2009). A multiple case study approach can highlight differences and similarities between the selected cases, which facilitates analytical generalization of the findings and allows for theory elaboration (Ketokivi and Choi, 2014; Voss *et al.*, 2002; Yin, 2003). This approach is particularly suitable here, as most research on CE and stakeholder engagement is quantitative (Baah *et al.*, 2022; Chiappetta Jabbour *et al.*, 2020; Jakhar *et al.*, 2019) or based on literature reviews (Calicchio Berardi and Peregrino de Brito, 2021; Govindan and Hasanagic, 2018), while there is a lack of in-depth empirical insight into how stakeholder engagement can advance CE implementation (Blomsma *et al.*, 2019; Ketokivi and Choi, 2014; Lahane *et al.*, 2020).

### *3.1 Case selection*

The case companies were chosen by pursuing purposeful sampling of information-rich cases (Yin, 2003). To select the case companies, the following selection criteria were applied: (1) The company has recently started to work systematically with sustainability. This was assessed by searching for companies that have recently published their first sustainability report. Sustainability reporting has been recognized as a key element of organizational management activities (Baumgartner and Rauter, 2017; Maas *et al.*, 2016) and publishing a sustainability report can, therefore, be used as an indicator of progress regarding systematic sustainability efforts. (2) To allow for certain comparability between the organizations and the role of stakeholder engagement, the focus was on Swedish manufacturing organizations. Governmental institutions such as the European Union and its member states have been advocating CE (EC, 2022b; Government Offices of Sweden, 2020). Sweden is recognized as a frontrunner in regard to sustainability initiatives, but Sweden's economy remains largely linear (Circle Economy, 2020; Hametner and Kostetckaia, 2020). As CE approaches are often context-specific (Tura *et al.*, 2019), this ensured that the case companies face similar socioeconomic and competitive pressures and incentives to advance their sustainability and CE efforts. (3) To increase external validity, case companies representing different industries were chosen. Studies have shown that independent of the size or sector, stakeholders exert an influence on the adoption and implementation of CE principles (Baah *et al.*, 2022; Chiappetta Jabbour *et al.*, 2020; Jakhar *et al.*, 2019). Consequently, similarities in the stakeholder engagement practices between the case companies may allow for analytical generalization.

To verify the fit of the case companies to the selection criteria, a first meeting with case company representatives was held to inform them about the study and gain an overview of the companies' sustainability efforts. Table 1 provides information about the case companies, whose names are withheld for confidentiality.

**Table 1.** Overview of the case company characteristics

| Case company | Company A | Company B | Company C |
|---|---|---|---|
| Headquarters | Sweden | Sweden | Sweden |
| Activity and number of employees (in 2020) | Global (1,064) | Global (890) | Global (3,515) |
| Net sales | SEK 1.4 million | SEK 1.584 million | SEK 7.263 million |
| Business | B2B, B2C | B2B | B2B |
| First sustainability report (GRI) | 2020 | 2020 | 2020 |

### 3.2 Data collection

As a primary method of data collection, 20 semi-structured interviews were conducted with employees in key positions (executives, managers, experts) who are able to provide information regarding aspects of the sustainability and CE approach as well as stakeholder engagement (Table 2). Semi-structured interviews are a common method in case study research, as they yield in-depth knowledge on the investigated phenomenon and allow the researcher to interact with the interview partner (Saunders *et al.*, 2009; Yin, 2003). Before the interviews were conducted, a case study protocol was established to increase study reliability, and interview questions were tested for understandability, duration and to clarify potential ambiguities (Yin, 2003).

The interviews were conducted between October 2021 and January 2022 via an online meeting program (Microsoft Teams) and lasted roughly between 30 and 60 min. At the beginning of the interview, the interviewees were briefed on the purpose of the study and guaranteed anonymity. The interviews had two parts. The first focused on how the case study company approaches and implements sustainability; the second focused on stakeholder engagement related to the sustainability efforts. All interviews but one were recorded and transcribed. Detailed notes were taken for the interview that was not recorded. The transcriptions were sent to the interviewees to check for potential errors and misunderstandings, thus ensuring internal validity (Yin, 2003). The interviews were conducted in English and Swedish; quotes were later translated into English. To raise validity, the data were complemented with secondary data drawn from various sources such as the companies' sustainability report, corporate websites and other publicly available documents (Yin, 2003).

### 3.3 Data analysis

The data were analyzed in a multistep process following the guidelines from Gioia *et al.* (2013) (Figure 3). The coding software NVivo 12 was used to facilitate the process and ensure analytical rigor.

To avoid the potential risk of reduced depth of analysis in multiple case studies, a case is usually analyzed first on its own and then cases are compared to each other, allowing for analytical generalizations (Saunders *et al.*, 2009; Voss *et al.*, 2002; Yin, 2003). The data were, therefore, first coded as a first-order analysis per case company, by reading the transcriptions line by line. The in-case analysis allowed for an in-depth familiarization and discovering patterns with each case individually, before matching it with the other cases (Voss *et al.*, 2002). After completing the in-case analysis, a cross-case analysis was conducted to identify

| Case company | Company A | Company B | Company C |
|---|---|---|---|
| Number of interviews | 4 | 7 | 9 |
| Job function of interviewees | • Head of sustainability<br>• CEO<br>• Sustainability manager<br>• Sustainability consultant | • Head of sustainability<br>• COO<br>• Head of purchasing<br>• Manager of software development<br>• Production engineer<br>• Mechanical engineer<br>• Sustainable engineer and R&D | • Head of sustainability<br>• COO<br>• SVP product and marketing<br>• SVP investor relations and corporate communication<br>• Directors of global R&D (2)<br>• Heads of category (2)<br>• Open innovation leader |

**Table 2.**
Overview of the interviews conducted

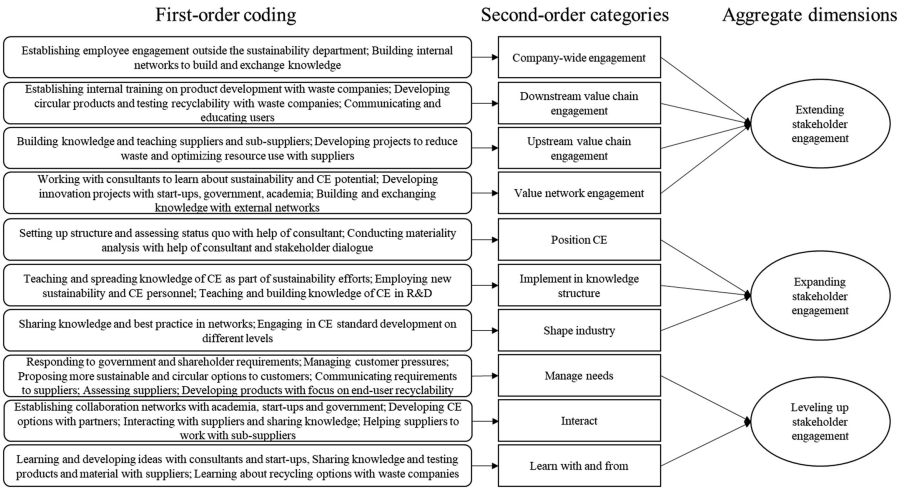



**Figure 3.**
Data analysis structure

similarities, and this was cross-checked by the authors. Axial coding was applied to find potential connections between the codes, allowing for the reduction and categorization of the data, as well as developing comprehensive second-order categories (Gioia *et al.*, 2013). The authors then discussed the results and synthesized them to validate the findings through data triangulation (Yin, 2003). This helped to find dynamic relationships among the second-order categories. The results were then summarized in key categories, also called aggregate dimensions (Gioia *et al.*, 2013). The findings were presented to a representative from each case company for validation.

## 4. Results

All three companies engage with a variety of stakeholders. The results are presented according to the aggregated dimensions developed during the analysis. Appendix provides supporting evidence from the empirical data for each aggregated dimension. Through comparison and sorting, three propositions were extracted from the cross-case analysis.

### *4.1 Extending stakeholder engagement*

All three companies emphasize the importance of integrating sustainability and CE into their organizational practices and the need to establish new partnerships to achieve this. However, the establishment of circularity and sustainability is perceived as difficult; so far there has been a lack of knowledge both internally as well as down- and upstream in the supply chain about where products come from and where they are going. In addition, Company C refers to problems in the infrastructure that do not always allow for a more circular supply chain. To move toward sustainability and CE, the results showed that all three case companies extended with whom they engaged considering new internal, supply chain and value network stakeholders.

Internally, all case companies emphasized developing high employee engagement outside the sustainability department through building and exchanging knowledge. The case companies aim to build company-wide networks including all functional areas to facilitate the implementation of sustainability and CE. Company A established an internal ambassador network with employees from various functions and regions that meets regularly to create a

common sustainability understanding, learn from each other and share best practices. The aim is for the participating employees to bring back the inputs and enable the implementation of sustainability and CE by engaging their colleagues on this issue. A respondent from Company A explains that the network already facilitated the reuse of product components, which would have not happened without the network, due to a lack of knowledge. The increased internal sharing of knowledge with different organizational functions and facilities also led to a new approach to waste reduction by reusing packaging material waste. A similar group existed within Company B but was replaced with the establishment of the sustainability department. However, a respondent from Company B explained that the sustainability department aims to have meetings with all functions within the company to enhance awareness of the CE and sustainability approach and create greater internal engagement. Company C states that all employees are aware of the sustainability aims of the case company and that company-wide implementation has been ongoing for a long time. However, employees within various departments such as R&D also engage their colleagues to jointly develop a CE understanding guiding their work and share ideas with other departments.

The results show that the case companies extended their internal stakeholder engagement from being instigated by the sustainability department, to sustainability and CE ambassadors and networks involving employees in different positions and functions. This enabled the case companies to develop a better CE understanding and by doing so implement CE in organizational practices. Based on these results, the following is proposed:

*Proposition 1a.* Extending internal stakeholder engagement from the sustainability department to company-wide networks has a positive effect on implementing CE in organizational practices.

From a downstream perspective, all three companies aim to close knowledge gaps and have started to engage more with waste companies to better understand CE and assess the CE potential of their products, such as their recyclability. For example, Company A plans to develop training in product development together with a waste company, as well as to jointly develop more circular products together, aiming to reduce waste disposal and increase the recycling and reusing of products and product components in the long term. Companies B and C also explain that most resource use, emissions and waste occur in the use phase of their products in which they have traditionally not been involved and to which they have had no access, ownership or knowledge. Both Companies B and C, therefore, focus increasingly on communicating with users and educating them on the topic. Further, both companies discuss how to establish better recycling options for users, as well as developing product components that allow for better product use, reducing waste and extending product life within the supply chain. Company A also aims to distribute more information about their products and sustainability work to external actors and to educate product users.

From an upstream perspective, Companies A and B state that there has been limited knowledge regarding their supply chain outside Europe and what material is really in a product, which makes it difficult to develop reuse or recycling strategies. Therefore, the companies have started to engage more with their suppliers as well as their sub-suppliers and help them implement sustainability and circularity thinking in their organization more strategically. All three companies have also started interaction projects with suppliers, sharing knowledge and developing and testing ideas on how to increase circularity and they plan to involve suppliers more in the future. For example, Company A started a project to reduce waste together with suppliers. However, Company B also mentions that it can be difficult to find a supplier that has time to test new material beyond the usual production timeframe.

The results show that the case companies extended their external stakeholder engagement beyond their direct supply chain stakeholders to also include stakeholders

such as sub-suppliers, waste companies and users and also aimed to create higher levels of engagement among these stakeholders, even though there was little or no engagement previously. This allowed the case companies to develop a better CE understanding and as a result, implement CE in organizational practices. Based on these results, the following is proposed:

*Proposition 1b.* Extending external stakeholder engagement across the whole supply chain has a positive effect on implementing CE in organizational practices.

All three companies extended their stakeholder engagement beyond their supply chain. Companies B and C point out that to implement CE in organizational practice and supply chains, start-ups and consultants that bring new, innovative ideas into the market play an increasing role. For example, Company C started a partnership with a consultant to learn about circular business opportunities and how to put them into practice. In addition, engagement with academia plays an important role for the companies. Company B is part of a university board overseeing various engagement projects. Company C established an innovation hub together with various academic institutions, governmental institutions and other organizations so as to create possibilities for developing innovative sustainable and circular products and product components. Company C is also involved in giving workshops and lectures at universities to spread knowledge and open the door for future joint projects. All three companies also participate in networks both related and unrelated to the industry to discuss issues on a broader level and to learn about and share ideas regarding sustainability and CE. The organizational shareholders, civil society groups, business and governmental institutions organize these networks. In some, even competitors are present, but engagement with competitors is mainly limited to benchmarking the sustainability and CE efforts. The case companies were also engaged with local communities and NGOs that had a sustainability and CE background. However, these projects were not focused on the companies' particular practices or supply chain.

The results show that the case companies extended their external stakeholder engagement by considering new engagement options and stakeholder relationships such as with governmental institutions, consultants, academia and sustainability and CE networks. This allowed the case companies to develop a better CE understanding and with that, implement CE in organizational practices. Based on these results, the following is proposed:

*Proposition 1c.* Extending external stakeholder engagement beyond the direct supply chain has a positive effect on implementing CE in organizational practices.

### *4.2 Expanding stakeholder engagement*

The results showed that all three companies expanded the focus on what they engage with stakeholders to enable the implementation of CE in organizational practices. Companies A and B employed consultants when they started to work strategically with sustainability, due to a lack of internal knowledge on the issue. The consultant helped the companies to establish the internal and external structure for working with sustainability, for example data gathering to publish a sustainability report, as well as conducting a materiality analysis to assess which sustainability topics are the most relevant for them, such as circularity. In addition, Companies A and B conducted a materiality analysis in conjunction with a stakeholder dialog. Company A included a broad number of stakeholders such as employees and owners, as well as suppliers, customers and even considered the environment as a stakeholder. Company B mainly focused on employees and management in different

functions, as well as the board of directors and customers. Company C developed their sustainability strategy through an internal process. The results helped to shape sustainability vision and strategies and led to positioning CE as a key element of the sustainability approach of Companies A and B. Company C also engages with other stakeholders such as consultants, to assess opportunities for positioning CE within the business.

Nevertheless, respondents from Companies A and B mentioned that not all employees are equally interested in the topic and that there are different perspectives in different departments, as well as different levels of implementation of sustainability and circularity, depending on production facility location. In particular, in Company B, the differences between CE and sustainability thinking became clear, when interviewees outside the sustainability department did not connect circular activities with the company sustainability efforts. All three case companies, therefore, emphasize explicitly considering CE as part of the sustainability efforts and in their internal and external stakeholder engagement activities.

The results show that the case companies expanded their stakeholder engagement from engaging stakeholders on sustainability topics to explicitly considering CE. This allowed the case companies to position CE as part of the sustainability efforts and implement it in their organizational practices. Based on these results, the following is proposed:

*Proposition 2a.* Expanding stakeholder engagement by explicitly considering CE as part of the sustainability efforts has a positive effect on implementing CE in organizational practices.

All three companies highlighted differences in understanding sustainability and circularity in the different geographical regions in which they operate, for example what recycling encompasses. Respondents from Company A and B referred to the risk that in other countries, CE and recyclability can mean different things. In addition, all three companies point out that it is still difficult to define and implement CE in their organizational practices. Companies A and C highlight that they are in a phase of learning about what CE encompasses and that circularity is difficult to measure, which makes it difficult to establish specific goals. To deal with these issues, Companies A and B have employed personnel that focusses specifically on sustainability engineering and modularity in product development. Company A also expresses its aim to develop training programs for employees, and particularly for R&D, so as to learn about modularity and circularity to secure the effective implementation of CE in product design. A respondent from Company C explained that when they started to work with the topic in R&D, they had a workshop on understanding CE principles. These employees can develop and innovate product and services by engaging colleagues, suppliers and customers in the process.

The results show that the case companies expanded their stakeholder engagement by moving from knowledge dissemination by the sustainability department to fostering CE experts within various organizational functions. This allowed the case companies to establish a CE knowledge structure throughout the organization and implement CE. Based on these results, the following is proposed:

*Proposition 2b.* Expanding stakeholder engagement to develop a CE knowledge structure has a positive effect on implementing CE in organizational practices.

The sustainability department of the case companies not only aimed for disseminating CE knowledge and implementing a CE knowledge structure within the company, but also expanded their engagement approach by participating in initiatives that foster and shape CE approaches for the whole industry. For example, Companies B and C are involved in developing circularity standards for products and for the whole industry, led by governmental and non-governmental institutions. By participating in such initiatives, the

case companies influence the implementation of CE beyond their organizational focus and their supply chain. Based on these results, the following is proposed:

*Proposition 2c.* Expanding stakeholder engagement to influence the development of CE approaches and standards beyond the organizational and supply chain focus has a positive effect on implementing CE in organizational practices.

### *4.3 Leveling up stakeholder engagement*

The results showed that all three companies leveled up how they engaged with stakeholders, moving from focusing mainly on the management of specific stakeholders' needs to simultaneously initiating interaction projects and enabling learning with and from different stakeholders. This allowed the case companies to advance their CE approach as part of their sustainability efforts. For example, all three companies described how they started to work with sustainability systematically, based on pressures from shareholders and governmental institutions, for example to publish a sustainability report. All three companies stated that they are also feeling increasing pressure from their customers to work on sustainability and CE topics. For example, respondents from Companies B and C said that customers now impose more requirements regarding product and material performance. Company A also mentioned that customers and users increasingly ask for sustainability certifications. On the other hand, all three organizations perceive that their customers do not want to pay a higher price for more sustainable and circular products, such as products with higher recyclability, which inevitably makes changes difficult. From an upstream perspective, all three companies stated that suppliers have been traditionally chosen on economic considerations, while sustainability played a minor role. Sustainability and CE requirements from customers were mainly passed down as part of the selection criteria.

The case companies highlighted that they have started to approach customers proactively to propose more sustainable and circular options for product components. For example, a respondent from Company B highlighted a workshop they had organized with a customer to develop ideas for product development, and a pilot project they had started for a new product based on recycled materials. Companies A and C stated that they are increasingly focusing on customer-oriented innovation by investing in more modular product development. In addition, R&D in Company B focuses on product development that is easier for the end user to take apart, proactively responding to customer and user needs.

When starting to work strategically with sustainability, Company A also began to focus more on its supply chain, defining its boundaries and impact and assessing suppliers regarding their sustainability efforts and which materials they use in their products. Further, with the increased focus on sustainability and CE, Companies A and C started more in-depth stakeholder dialogs and surveys with suppliers along the whole supply chain and developed a code of conduct for suppliers that integrates CE and other environmental issues. In addition, all three companies refer to joint learning on the topic with their suppliers and sub-suppliers, encompassing training, development and testing CE-oriented material and products to enable the development of more sustainable and circular products and product components.

In addition, all case companies established engagement activities with users, waste management companies and other stakeholders such as consultants, academia and governmental institutions on different levels: to communicate better recycling approaches, to learn about CE potential such as recycling options and to establish interaction approaches to innovate the organizational practices and supply chain toward CE. This encompasses both short-term product component innovation to increase modularity and lower resource use and enhance long-term product innovation with a greater focus on reuse and redesign.

The results show that it is necessary to simultaneously consider managing needs and proactively start interaction projects and jointly learn with the same stakeholders so as to develop CE solutions and implement CE in the organizational practices and supply chain. Based on these results, the following is proposed:

*Proposition 3.* Leveling up the stakeholder engagement has a positive effect on implementing CE in organizational practices.

## 5. Discussion

Stakeholder engagement plays an important role for manufacturing organizations wishing to approach both sustainability and CE and implement it in organizational practices such as SCM (Calicchio Berardi and Peregrino de Brito, 2021; Marjamaa *et al.*, 2021; Mishra *et al.*, 2019). However, similar to the conceptual differences when it comes to implementing CE and sustainability, the stakeholder engagement approach also needs to be adapted to enable the implementation of CE (Allen *et al.*, 2021; Chiappetta Jabbour *et al.*, 2019). The study results led to three propositions highlighting that transitioning to CE requires not only resource flows to change from linear to circular, but also a stakeholder engagement approach to make the same changes. Such circular stakeholder engagement based on extending, expanding and leveling up the engagement can support manufacturing organizations in implementing CE as part of their sustainability efforts in their organizational practices and supply chain (Figure 4).

By extending the engagement the issue of *with whom* organizations engage is modified and new and relevant internal, supply chain and value network stakeholders are considered, both to engage with them as well as the engagement between these stakeholders, thus changing the direction of engagement from linear to circular. The results show that case companies not only aim to actively engage their employees, but also to establish internal CE and sustainability networks to involve various functional areas in the process. This may help in preventing CE efforts from remaining within the sustainability department (Hofmann and Jaeger-Erben, 2020). From a supply chain perspective, while customers and suppliers have been recognized as relevant stakeholders to initiate the process of working with sustainability and approaching CE in line with the SSCM and CSCM literature (Govindan and Hasanagic, 2018; Jakhar *et al.*, 2019;

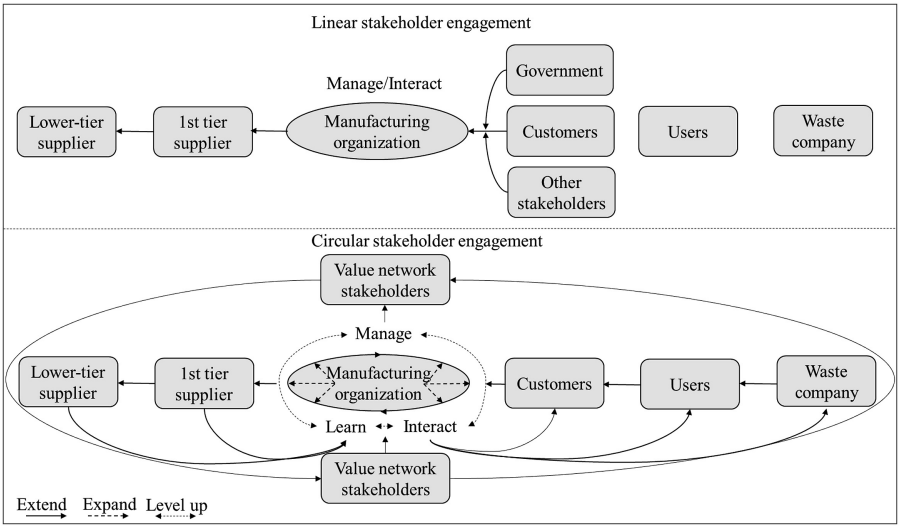



**Figure 4.**
From linear to circular stakeholder engagement

Meixell and Luoma, 2015), this study highlighted the importance of extending the stakeholder engagement efforts along the supply chain to users, waste companies and sub-suppliers, so as to learn about and assess CE options of products and materials (Bertassini *et al.*, 2021; Shah and Bookbinder, 2022; Wang *et al.*, 2022). This not only helps to overcome a lack of knowledge of product origin and the product-use phase, but may also contribute to closing the access gap stemming from linear supply chain infrastructures, thus facilitating the move from linear to circular resource flows (Guldmann and Huulgaard, 2020; Hofmann and Jaeger-Erben, 2020; Tura *et al.*, 2019).

While the SSCM literature increasingly advocates engaging nontraditional stakeholders (Carmagnac, 2021), the results of this study indicate differences in the role of such stakeholders when it comes to engaging in sustainability and CE. In contrast to linear stakeholder engagement approaches, governmental institutions no longer mainly influence the implementation of sustainability and CE, as often discussed in the literature (Baah *et al.*, 2022; Govindan and Hasanagic, 2018; Meixell and Luoma, 2015), but also affect the implementation through networks and joint interaction. Governmental institutions are, therefore, integrated into the value network when approaching circular stakeholder engagement (Figure 4) (Bertassini *et al.*, 2021; Wang *et al.*, 2022). In line with Wang *et al.* (2022), stakeholders such as NGOs, local communities and competitors were found to play a limited role when it comes to implementing CE in the organizational practices, which have been frequently considered for advancing sustainability in supply chains (Carmagnac, 2021; Chen *et al.*, 2017; Meixell and Luoma, 2015). Instead, stakeholders such as consultants, start-ups and academia and various networks were found to be important for supporting organizations in handling the complexity of CE, assessing CE potential and facilitating the implementation of CSCM, which have only play a limited role for SSCM implementation and previous CE research (Chen *et al.*, 2017; Meixell and Luoma, 2015; Wang *et al.*, 2022). This may be due to the different aims of implementing sustainability and CE along the supply chain, leading to stakeholders playing different roles (Farooque *et al.*, 2019b; Genovese *et al.*, 2017). Nevertheless, this study highlights that stakeholder engagement in the CE context not only requires extending the engagement along the supply chain, but also toward other and new relevant stakeholders in the value network that have not been considered in the SSCM context (Bertassini *et al.*, 2021; Chen *et al.*, 2017; Meixell and Luoma, 2015). Thus, the study not only validates previous findings in CE literature, but also indicates a new complexity of engaging stakeholders for CE, where conceptual understanding from SSCM literature cannot be applied without being adapted (Allen *et al.*, 2021).

By expanding the engagement, the focus of *on what* organizations engage is modified, grounded in a change from linear to circular thinking. This change is manifested by engaging stakeholders in positioning CE as part of the sustainability efforts, implementing a CE knowledge structure internally, as well as externally through shaping industry standards. While the linkage between CE and sustainability is still under discussion (Allen *et al.*, 2021; Bjørnbet *et al.*, 2021; Geissdoerfer *et al.*, 2017), stakeholders need to be explicitly engaged when it comes to CE transitions, and organizations need to create awareness as to how the CE efforts are connected to the sustainability approach (Frishammar and Parida, 2019; Salvioni and Almici, 2020). Such an expansion of stakeholder engagement, however, does not necessarily enable the implementation of CE if knowledge and awareness on CE and sustainability topics remain within the sustainability department. Understanding the relationship between sustainability and CE and what the implementation at the product level, for R&D as well as for the supply chain, requires needs not only to be communicated but also expanded by establishing knowledge dissemination from various CE experts in different organizational functions (in line with Hofmann and Jaeger-Erben, 2020). While sharing knowledge and decreasing differences in understanding in different geographic locations and along the supply chain may also be needed when focusing only on implementing

sustainability (Hörisch *et al.*, 2014; Kumar *et al.*, 2019; Tura *et al.*, 2019); expanding stakeholder engagement in the CE context involves reconsidering how established knowledge and approaches can be modified from linear to circular, co-constructing knowledge and shaping the industry through stakeholder engagement (Salvioni and Almici, 2020; Tapaninaho and Heikkinen, 2022).

By leveling up the engagement, *how* organizations engage is modified, changing the level of engagement practices from linear to circular. The results show that the case companies leveled up their engagement to simultaneously manage their stakeholder needs, initiate learning on CE and establish interaction projects with the same stakeholders to enable the implementation of CE (Freeman *et al.*, 2017; Salem *et al.*, 2018; Salvioni and Almici, 2020). Similar to SSCM being often based on linear thinking, stakeholder engagement for manufacturing organizations to implement sustainability in supply chains has been described in linear approaches focusing on receiving pressure from stakeholders and sending it to upstream suppliers (Seuring and Müller, 2008; Wilhelm *et al.*, 2016). While the identification of stakeholder interest and responding to pressures to adopt CE is crucial to building a foundation for stakeholder engagement for CE (Baah *et al.*, 2022; Marjamaa *et al.*, 2021), this study highlights that the case companies modified their engagement to also proactively approaching their customers to propose CE options to facilitate recycling and remanufacturing options, as well expecting suppliers to propose ideas and jointly develop and test develop CE-oriented material and products. Consequently, transitioning from linear to circular stakeholder engagement allows for more balanced relationships along the supply chain and may help to overcome barriers such as customer disinterest and a lack of suitable partners, as discussed in the literature (Jaeger and Upadhyay, 2020; Masi *et al.*, 2018; Vermunt *et al.*, 2019). It should be noted that circular stakeholder engagement may also contribute to sustainable development, but in particular, enables a transition toward CE, while engagement focused on implementing sustainability does not necessarily allow moving toward more circular value flows (Farooque *et al.*, 2019b; Genovese *et al.*, 2017). Thus, the results highlight the importance of adapting the conceptual understanding of stakeholder engagement in the CE context and the role of circular stakeholder engagement practices for moving toward a CE in manufacturing organizations (Allen *et al.*, 2021).

## 6. Conclusions and future research

The CE has been acknowledged as a key approach to overcoming sustainability challenges. Despite the growing body of literature on the benefits, drivers and barriers for CE, only a few companies have made the transition. Research has highlighted stakeholder engagement as a critical factor for organizations in implementing CE principles. However, while there is an increasing amount of research on implementing CE, there is still a lack of understanding and of applying stakeholder theory in the CE context.

The results of this study contribute both to the theoretical and practical debate on CE. First, building on stakeholder theory, this paper sheds light on stakeholder engagement practices in CE context including relevant stakeholders, the focus and engagement approach. Second, by proposing to extend, expand and level up the stakeholder engagement to approach CE, the study highlights how stakeholder engagement in the CE context need to be adapted from stakeholder engagement, as portrayed in the SSCM literature. Thus, this study contributes to the intersection of CE, stakeholder theory and SCM literature, providing an enhanced conceptual understanding of stakeholder engagement for moving toward CE from an overarching perspective.

Third, the three propositions presented in this study offer insights into how manufacturing organizations engage stakeholders to implement CE as part of the sustainability efforts, moving the spotlight from linear to circular stakeholder engagement

practices. A better understanding of stakeholder engagement in the CE context allows for more grounded decision-making when it comes to implementing CE in the organizational practices and supply chain. This may also help practitioners to rethink and evaluate their stakeholder engagement efforts. Establishing circular stakeholder engagement practices plays an important role for the transition toward CE in manufacturing organizations.

Some limitations should be noted. This study focused on stakeholder engagement in manufacturing organizations in Sweden, which may limit its generalizability. However, the three companies operate on a global level and are both affected by and affect a broad range of stakeholders as well as governmental regulations toward working with sustainability and CE covering the European region. The results of this study may, therefore, still allow for analytical generalization. Another limitation might be due to semi-structured interviews being the main source of data: the results might be affected by respondents being biased by their own perceptions. Future research should be conducted with organizations of different sizes and located in different regions, to test the proposed circular stakeholder engagement practices. Future research on how the impact of circular stakeholder engagement practices to approach CE and implement CSCM works in the long term, could be conducted, focusing on longitudinal studies.

## References

Allen, S.D., Zhu, Q. and Sarkis, J. (2021), "Expanding conceptual boundaries of the sustainable supply chain management and circular economy nexus", *Cleaner Logistics and Supply Chain*, The Authors, Vol. 2 October, p. 100011.

Aloini, D., Dulmin, R., Mininno, V., Stefanini, A. and Zerbino, P. (2020), "Driving the transition to a circular economic model: a systematic review on drivers and critical success factors in circular economy", *Sustainability*, Vol. 12 No. 24, pp. 1-14.

Baah, C., Afum, E., Agyabeng-Mensah, Y. and Agyeman, D.O. (2022), "Stakeholder influence on adoption of circular economy principles: measuring implications for satisfaction and green legitimacy", *Circular Economy and Sustainability, Circular Economy and Sustainability*, Vol. 2 No. 1, pp. 91-111.

Baumgartner, R.J. and Rauter, R. (2017), "Strategic perspectives of corporate sustainability management to develop a sustainable organization", *Journal of Cleaner Production*, Vol. 140, pp. 81-92.

Bertassini, A.C., Zanon, L.G., Azarias, J.G., Gerolamo, M.C. and Ometto, A.R. (2021), "Circular Business Ecosystem Innovation: a guide for mapping stakeholders, capturing values, and finding new opportunities", *Sustainable Production and Consumption*, Elsevier B.V, Vol. 27, pp. 436-448.

Bjørnbet, M.M., Skaar, C., Fet, A.M. and Schulte, K.Ø. (2021), "Circular economy in manufacturing companies: a review of case study literature", *Journal of Cleaner Production*, Elsevier, Vol. 294, doi: 10.1016/j.jclepro.2021.126268.

Blomsma, F., Pieroni, M., Kravchenko, M., Pigosso, D.C.A., Hildenbrand, J., Kristinsdottir, A.R., Kristoffersen, E., Shahbazi, S., Nielsen, K.D., Jönbrink, A.-K., Li, J., Wiik, C. and McAloone, T.C. (2019), "Developing a circular strategies framework for manufacturing companies to support circular economy-oriented innovation", *Journal of Cleaner Production*, Vol. 241, doi: 10.1016/j.jclepro.2019.118271.

Bocken, N.M.P., Schuit, C.S.C. and Kraaijenhagen, C. (2018), "Experimenting with a circular business model: lessons from eight cases", *Environmental Innovation and Societal Transitions*, Elsevier Vol. 28 December, pp. 79-95.

Bryson, J.M. (2004), "What to do when stakeholders matter. Stakeholder identification and analysis techniques", *Public Management Review*, Vol. 6 No. 1, pp. 21-53.

Calicchio Berardi, P. and Peregrino de Brito, R. (2021), "Supply chain collaboration for a circular economy - from transition to continuous improvement", *Journal of Cleaner Production*, Elsevier, Vol. 328, p. 129511.

Carmagnac, L. (2021), "Expanding the boundaries of SSCM: the role of non-traditional actors", *Supply Chain Forum*, Taylor & Francis, Vol. 22 No. 3, pp. 192-204.

Chang, R.D., Zuo, J., Zhao, Z.Y., Zillante, G., Gan, X.L. and Soebarto, V. (2017), "Evolving theories of sustainability and firms: history, future directions and implications for renewable energy research", *Renewable and Sustainable Energy Reviews*, Vol. 72 January, pp. 48-56.

Chen, L., Zhao, X., Tang, O., Price, L., Zhang, S. and Zhu, W. (2017), "Supply chain collaboration for sustainability: a literature review and future research agenda", *International Journal of Production Economics*, Vol. 194 April, pp. 73-87.

Chiappetta Jabbour, C.J., Sarkis, J., Lopes de Sousa Jabbour, A.B., Scott Renwick, D.W., Singh, S.K., Grebinevych, O., Kruglianskas, I. and Godinho Filho, M. (2019), *Cleaner Production*, Elsevier, Vol. 222, pp. 793-801.

Chiappetta Jabbour, C.J., Seuring, S., Lopes de Sousa Jabbour, A.B., Jugend, D., De Camargo Fiorini, P., Latan, H. and Izeppi, W.C. (2020), "Stakeholders, innovative business models for the circular economy and sustainable performance of firms in an emerging economy facing institutional voids", *Journal of Environmental Management*, Elsevier, Vol. 264 March, doi: 10.1016/j.jenvman.2020.110416.

Circle Economy (2020), "The circularity gap report 2020", Amsterdam, available at: https://www.circularity-gap.world/

De Angelis, R. (2021), "Circular economy business models: a repertoire of theoretical relationships and a research agenda", *Circular Economy and Sustainability*, Springer International Publishing, No. 0123456789, doi: 10.1007/s43615-021-00133-x.

De Angelis, R., Howard, M. and Miemczyk, J. (2018), "Supply chain management and the circular economy: towards the circular supply chain", *Production Planning and Control*, Vol. 29 No. 6, pp. 425-437.

Del Giudice, M., Chierici, R., Mazzucchelli, A. and Fiano, F. (2020), "Supply chain management in the era of circular economy: the moderating effect of big data", *International Journal of Logistics Management*, Vol. 32 No. 2, pp. 337-356.

Ellen MacArthur Foundation (2022), "What is a circular economy?", available at: https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview (accessed 28 February 2022).

European Commission (EC) (2022a), "Waste framework directive", available at: https://environment.ec.europa.eu/topics/waste-and-recycling/waste-framework-directive_en

European Commission (EC) (2022b), "Circular economy action plan", available at: https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en

Fadeeva, Z. (2005), "Promise of sustainability collaboration—potential fulfilled?", *Journal of Cleaner Production*, Vol. 13 No. 2, pp. 165-174.

Farooque, M., Zhang, A. and Liu, Y. (2019a), "Barriers to circular food supply chains in China", *Supply Chain Management*, Vol. 24 No. 5, pp. 677-696.

Farooque, M., Zhang, A., Thürer, M., Qu, T. and Huisingh, D. (2019b), "Circular supply chain management: a definition and structured literature review", *Journal of Cleaner Production*, Vol. 228 April, pp. 882-900.

Freeman, R.E. (1984), *Strategic Management: Stakeholder Approach*, Pitman, Boston.

Freeman, R.E. (2010), "Managing for stakeholders: trade-offs or value creation", *Journal of Business Ethics*, Vol. 96 June, pp. 7-9.

Freeman, R.E., Kujala, J., Sachs, S. and Stutz, C. (2017), "Stakeholder engagement: practicing the ideas of stakeholder theory", in Freeman, R.E., Kujala, J. and Sachs, S. (Eds), *Stakeholder Engagement: Clinical Research Cases*, Springer, Zurich, pp. 1-12.

Frishammar, J. and Parida, V. (2019), "Circular business model transformation: a roadmap for incumbent firms", *California Management Review*, Vol. 61 No. 2, pp. 5-29.

Geissdoerfer, M., Savaget, P., Bocken, N.M.P. and Hultink, E.J. (2017), "The Circular Economy – a new sustainability paradigm?", *Journal of Cleaner Production*, Elsevier, Vol. 143, pp. 757-768.

Geissdoerfer, M., Morioka, S.N., de Carvalho, M.M. and Evans, S. (2018), "Business models and supply chains for the circular economy", *Journal of Cleaner Production*, Elsevier, Vol. 190, pp. 712-721.

Genovese, A., Acquaye, A.A., Figueroa, A. and Koh, S.C.L. (2017), "Sustainable supply chain management and the transition towards a circular economy: evidence and some applications", *Omega (United Kingdom)*, Elsevier, Vol. 66, pp. 344-357.

Ghisellini, P., Cialani, C. and Ulgiati, S. (2016), "A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems", *Journal of Cleaner Production*, Elsevier, Vol. 114, pp. 11-32.

Gimenez, C. and Tachizawa, E.M. (2012), "Extending sustainability to suppliers: a systematic literature review", *Supply Chain Management*, Vol. 17 No. 5, pp. 531-543.

Gioia, D.A., Corley, K.G. and Hamilton, A.L. (2013), "Seeking qualitative rigor in inductive research: notes on the Gioia methodology", *Organizational Research Methods*, Vol. 16 No. 1, pp. 15-31.

Government Offices of Sweden (2020), "Sweden transitioning to a circular economy", available at: https://www.government.se/press-releases/2020/07/sweden-transitioning-to-a-circular-economy/

Govindan, K. and Hasanagic, M. (2018), "A systematic review on drivers, barriers, and practices towards circular economy: a supply chain perspective", *International Journal of Production Research*, Taylor & Francis, Vol. 56 Nos 1-2, pp. 278-311.

Greenwood, M. (2007), "Stakeholder engagement: beyond the myth of social responsibility", *Journal of Business Ethics*, Vol. 74 No. 4, pp. 315-327.

Guldmann, E. and Huulgaard, R.D. (2020), "Barriers to circular business model innovation: a multiple-case study", *Journal of Cleaner Production*, Elsevier, Vol. 243, p. 118160.

Gupta, S., Chen, H., Hazen, B.T., Kaur, S. and Santibañez Gonzalez, E.D.R. (2019), "Circular economy and big data analytics: a stakeholder perspective", *Technological Forecasting and Social Change*, Elsevier, Vol. 144 October, pp. 466-474.

Hametner, M. and Kostetckaia, M. (2020), "Frontrunners and laggards: how fast are the EU member states progressing towards the sustainable development goals?", *Ecological Economics, Elsevier*, Vol. 177 July,doi: 10.1016/j.ecolecon.2020.106775.

Hörisch, J., Freeman, R.E. and Schaltegger, S. (2014), "Applying stakeholder theory in sustainability management: links, similarities, dissimilarities, and a conceptual framework", *Organization and Environment*, Vol. 27 No. 4, pp. 328-346.

Hofmann, F. and Jaeger-Erben, M. (2020), "Organizational transition management of circular business model innovations", *Business Strategy and the Environment*, Vol. 29 No. 6, pp. 2770-2788.

Jaeger, B. and Upadhyay, A. (2020), "Understanding barriers to circular economy: cases from the manufacturing industry", *Journal of Enterprise Information Management*, Vol. 33 No. 4, pp. 729-745.

Jakhar, S.K., Mangla, S.K., Luthra, S. and Kusi-Sarpong, S. (2019), "When stakeholder pressure drives the circular economy: measuring the mediating role of innovation capabilities", *Management Decision*, Vol. 57 No. 4, pp. 904-920.

Ketokivi, M. and Choi, T. (2014), "Renaissance of case research as a scientific method", *Journal of Operations Management*, Elsevier B.V, Vol. 32 No. 5, pp. 232-240.

Ki, C.W., Chong, S.M. and Ha-Brookshire, J.E. (2020), "How fashion can achieve sustainable development through a circular economy and stakeholder engagement: a systematic literature review", *Corporate Social Responsibility and Environmental Management*, Vol. 27 No. 6, pp. 2401-2424.

Kirchherr, J., Reike, D. and Hekkert, M. (2017), "Conceptualizing the circular economy: an analysis of 114 definitions", *Resources, Conservation and Recycling*, Vol. 127 April, pp. 221-232.

Kumar, V., Sezersan, I., Garza-Reyes, J.A., Gonzalez, E.D.R.S. and Al-Shboul, M.A. (2019), "Circular economy in the manufacturing sector: benefits, opportunities and barriers", *Management Decision*, Vol. 57 No. 4, pp. 1067-1086.

Lahane, S., Kant, R. and Shankar, R. (2020), "Circular supply chain management: a state-of-art review and future opportunities", *Journal of Cleaner Production*, Elsevier, Vol. 258, doi: 10.1016/j.jclepro.2020.120859.

Lieder, M. and Rashid, A. (2016), "Towards circular economy implementation: a comprehensive review in context of manufacturing industry", *Journal of Cleaner Production*, Elsevier, Vol. 115, pp. 36-51.

Maas, K., Schaltegger, S. and Crutzen, N. (2016), "Integrating corporate sustainability assessment, management accounting, control, and reporting", *Journal of Cleaner Production*, Vol. 136, pp. 237-248.

Marjamaa, M., Salminen, H., Kujala, J., Tapaninaho, R. and Heikkinen, A. (2021), "A sustainable circular economy: exploring stakeholder interests in Finland", *South Asian Journal of Business and Management Cases*, Vol. 10 No. 1, pp. 50-62.

Masi, D., Kumar, V., Garza-Reyes, J.A. and Godsell, J. (2018), "Towards a more circular economy: exploring the awareness, practices, and barriers from a focal firm perspective", *Production Planning and Control*, Taylor & Francis, Vol. 29 No. 6, pp. 539-550.

Meixell, M.J. and Luoma, P. (2015), "Stakeholder pressure in sustainable supply chain management: a systematic review", *International Journal of Physical Distribution and Logistics Management*, Vol. 45 Nos 1/2, pp. 69-89.

Mentzer, J.T., DeWitt, W., Keebler, J.S., Min, S., Nix, N.W., Smith, C.D. and Zacharia, Z.G. (2001), "Defining supply chain management", *Journal of Business Logistics*, Vol. 22 No. 2, pp. 1-25.

Mishra, J.L., Chiwenga, K.D. and Ali, K. (2019), "Collaboration as an enabler for circular economy: a case study of a developing country", *Management Decision*, Vol. 59 No. 8, pp. 1784-1800.

Pieroni, M.P.P., McAloone, T.C. and Pigosso, D.C.A. (2019), "Business model innovation for circular economy and sustainability: a review of approaches", *Journal of Cleaner Production*, Elsevier, Vol. 215, pp. 198-216.

Pinheiro, M.A.P., Jugend, D., Lopes de Sousa Jabbour, A.B., Chiappetta Jabbour, C.J. and Latan, H. (2022), "Circular economy-based new products and company performance: the role of stakeholders and Industry 4.0 technologies", *Business Strategy and the Environment*, Vol. 31 No. 1, pp. 483-499.

Rincón-Moreno, J., Ormazábal, M. and Jaca, C. (2021), "Stakeholder perspectives in transitioning to a local circular economy: a case study in Spain", *Circular Economy and Sustainability, Circular Economy and Sustainability*, Vol. 2, pp. 693-711, doi: 10.1007/s43615-021-00098-x.

Salem, M.A., Shawtari, F., Shamsudin, M.F. and Hussain, H.B.I. (2018), "The consequences of integrating stakeholder engagement in sustainable development (environmental perspectives)", *Sustainable Development*, Vol. 26 No. 3, pp. 255-268.

Salvioni, D. and Almici, A. (2020), "Circular economy and stakeholder engagement strategy", *Symphonya. Emerging Issues in Management*, Vol. 1, p. 26.

Samant, S.M. and Sangle, S. (2016), "A selected literature review on the changing role of stakeholders as value creators", *World Journal of Science, Technology and Sustainable Development*, Vol. 13 No. 2, pp. 100-119.

Santa-Maria, T., Vermeulen, W.J.V. and Baumgartner, R.J. (2021), Framing and assessing the emergent field of business model innovation for the circular economy: a combined literature review and multiple case study approach, *Sustainable Production and Consumption*, Elsevier B.V, Vol. 26 December, pp. 872-891.

Saunders, M., Lewis, P. and Thornhill, A. (2009), *Research Methods for Business Students*, Pearson, Harlow.

Seuring, S. and Müller, M. (2008), "From a literature review to a conceptual framework for sustainable supply chain management", *Journal of Cleaner Production*, Vol. 16 No. 15, pp. 1699-1710.

Shah, M.U. and Bookbinder, J.H. (2022), "Stakeholder theory and supply chains in the circular economy", in Bals, L., Tate, W.L. and Ellram, L.M. (Eds), *Cicular Economy Supply CHains. From Chains to Systems*, Emerald Publishing, Bingley, pp. 129-148.

Stadtler, H. (2008), "Supply chain management – an overview", in Stadtler, H. and Kilger, C. (Eds), *Supply Chain Management and Advanced Planning. Concepts, Models, Software, and Case Studies*, 4th ed., Berlin, pp. 9-36.

Stewart, R. and Niero, M. (2018), "Circular economy in corporate sustainability strategies: a review of corporate sustainability reports in the fast-moving consumer goods sector", *Business Strategy and the Environment*, Vol. 27 No. 7, pp. 1005-1022.

Tapaninaho, R. and Heikkinen, A. (2022), "Value creation in circular economy business for sustainability: a stakeholder relationship perspective", *Business Strategy and the Environment*, March, pp. 1-13.

Torres-Guevara, L.E., Prieto-Sandoval, V. and Mejia-Villa, A. (2021), "Success drivers for implementing circular economy: a case study from the building sector in Colombia", *Sustainability*, Vol. 13 No. 3, pp. 1-17.

Tura, N., Hanski, J., Ahola, T., Ståhle, M., Piiparinen, S. and Valkokari, P. (2019), "Unlocking circular business: a framework of barriers and drivers", *Journal of Cleaner Production*, Elsevier, Vol. 212, pp. 90-98.

Urbinati, A., Rosa, P., Sassanelli, C., Chiaroni, D. and Terzi, S. (2020), "Circular business models in the European manufacturing industry: a multiple case study analysis", *Journal of Cleaner Production*, Elsevier, Vol. 274, p. 122964.

Vachon, S. and Klassen, R.D. (2008), "Environmental management and manufacturing performance: the role of collaboration in the supply chain", *International Journal of Production Economics*, Vol. 111 No. 2, pp. 299-315.

Vermunt, D.A., Negro, S.O., Verweij, P.A., Kuppens, D.V. and Hekkert, M.P. (2019), "Exploring barriers to implementing different circular business models", *Journal of Cleaner Production*, Elsevier, Vol. 222, pp. 891-902.

Voss, C., Tsikriktsis, N. and Frohlich, M. (2002), "Case research in operations management", *International Journal of Operations and Production Management*, Vol. 22 No. 2, pp. 195-219.

Wang, J.X., Burke, H. and Zhang, A. (2022), "Overcoming barriers to circular product design", *International Journal of Production Economics*, Elsevier B.V, Vol. 243 July, p. 108346.

Wilhelm, M.M., Blome, C., Bhakoo, V. and Paulraj, A. (2016), "Sustainability in multi-tier supply chains: understanding the double agency role of the first-tier supplier", *Journal of Operations Management*, Vol. 41, pp. 42-60.

Yin, R.K. (2003), *Case Study Research. Design and Methods*, 3rd ed., Sage Publications, Thousand Oaks, CA.

Zhang, A., Wang, J.X., Farooque, M., Wang, Y. and Choi, T.M. (2021), "Multi-dimensional circular supply chain management: a comparative review of the state-of-the-art practices and research", *Transportation Research E: Logistics and Transportation Review*, Elsevier, Vol. 155 August, p. 102509.

## Appendix

| Coding categories | Company A | Company B | Company C |
|---|---|---|---|
| *Aggregate dimension extending stakeholder engagement* | | | |
| Company-wide engagement | • "We have established something that we call sustainability ambassadors. A network where from each country or entity someone participates"<br>• "And I have a nice example from the first meeting … he who is the manager in France asked, what to do with the [product component] that come back from customers when we replace spare parts and everything like that? And then he who … works with spare parts says 'God, send them back to us'. Because in 80% of cases, the [product component] are intact. Then we can send them to the supplier and then they can test them. And so we can get them back … they would never have talked to each other otherwise" | • "Nobody was talking about the sustainability except me and some few others. It's like in the beginning, I mean, someone in [COMPANY B] has gathered people from different departments to make his sustainability team …"<br>• "… preferably that one or two functions become responsible for working with sustainability and we should be able to have them as a sounding board and that they themselves can come up with what they can improve in their processes" | • "So we have also in the last time involved several parts of the company. Because there are a few initiatives here and there in the company that we are trying to merge into a community initiative"<br>• "And so there was a discussion in the team saying what does it mean for me in my daily job? … it can be different so everyone can do something. During the work day, but also privately. … I think the majority of employees I would say almost 100% recognize that these principles are already I would say in our DNA" |
| Downstream value chain engagement | • "In our efforts to finding ways to make a shift into a more circular business, we started out by evaluating the level of recyclability in our [products] … We sent a complete [product] to our recycling partner"<br>• "The idea is now that [waste company] will hopefully train our product developer" | • "… my idea was if [customer] tried to receive the old or you know used things, supply back to us so that we should be able to recycle those things. You know, having a small contract to be able to recycle …"<br>• "It's just that the entire supply chain needs to be set up that way. It's from the end consumers they need to know where to drop in a used product and how to use them and what we should do with it and how they can buy it again from another source"<br>• "We are going to work more with the material that we can separate here, … and look, how we can, how the end customer can easier take apart" | • "The collaboration that we have started a little with [waste company] there is partly that you can reuse certain components that can go to recycling and so that you make new components from then there is of course some parts that we can certainly use almost directly into production as well. It is a collaboration that we have started in the last years here that we are working on, and I think it can also be something for the future"<br>• "The problem has been that we have not managed to do it on our own … you are constantly competing with conditions in the linear economy, that you take something, buy something new, assemble it, set it up, send it out. This is how you usually get caught up in the purely economic discussions"<br>• "[User] habits have been analyzed, centering on how behaviors can affect the environment and the opportunities that exist to make these behaviors more sustainable" |

(*continued*)

**Table A1.** Example quotes per second-order category

| Coding categories | Company A | Company B | Company C |
|---|---|---|---|
| Upstream value chain engagement | • "... we had no idea where the plant was because it was handled by an agent and it's a little scary"<br>• "We have started ... a circularity analysis ... and there the suppliers got a big role now. To explore where does their material come from, what does it weigh, what impact does it have on the environment?"<br>• "Speaking of circularity and recycling, in ... they have found pallets and made a small wooden box that they send with warranty parts to the [product]" | • "And you cannot recycle [the products] because you do not know what's in them and a lot of things"<br>• "So I came up with a crazy idea with the materials that it should not work yet, but why do not we test? Because no one had done it what we know so. ... there is a lot of focus on our supplier that supply, make [material] for us"<br>• "And some suppliers they have so much to do so it's really hard to get through and get them, get the time" | • "When it comes to our suppliers we challenge them with you know with the list of restricted material to be used, and the fact that they have to go into the market with maybe more recyclable material"<br>• "It would be nice to understand that all the products, which is the impact of our products starting really from the scratch?" |
| Value network engagement | • "Then within [owners] group, I have been participating in meetings where all companies have gathered to discuss ... sustainability work a little more as an exchange of experiences ..."<br>• "... we have visited some of the companies not because they were the best in the world, but we thought they had done well then you can go there and watch and learn"<br>• "I like to collaborate with the university ..." | • "And that's why I talk about these consultants that will play a big role in order to do this ..."<br>• "We are always cooperating with a lot of others. I am in for example, attending a networking with other companies ... And where we are exchanging a lot of ideas and information"<br>• "[Company B] is a part of ... an external group of companies trying to match university plans for developing educations and different courses" | • "What we are looking for collaborating with some start-up companies more and more focus on circularity"<br>• "We just started collaboration with ... a consultant, ... try to focus on the area where you can take more advantages from circularity"<br>• "We are in European Commission working groups to release the energy level also for [product]"<br>• "The [department] has close collaborations with several European universities and research centers" |
| *Aggregate dimension expanding stakeholder engagement* | | | |
| Position CE | • "I have continuous dialogue with them [consultant]"<br>• "We did a stakeholder analysis ... and based on that we developed the different areas that are important to work with"<br>• "Next step is to analyze how we can build a more circular value chain the whole way from design to waste handling"<br>• "... we have some within the organization who seem to be dedicated and think it is interesting and then we have some who think that it's hard for them to just have more to do" | • "So then we did a lot of work with an external consultant to train the management"<br>• "We have circularity on the agenda and we need to update and find our own ways to work with the topic"<br>• "During the materiality analysis, the stakeholders reviewed 21 different sustainability topics" | • "We started to look at our product and what is sustainability, and what is a linear economy and what is a circular economy for us"<br>• "It is actually a good question what is meant by circularity"<br>• "It came as an initiative from R&D and what we wanted to do was to establish a forum based on the 4 sustainability principles reuse, recycle, remanufacturer and refurbish" |

**Table A1.** (*continued*)

| Coding categories | Company A | Company B | Company C |
|---|---|---|---|
| Implement in knowledge structure | • "In Sweden, we have a very good infrastructure in terms of waste management . . .. They do not have the same thing in France or in some other countries in Europe"<br>• "It is difficult to say that everyone who comes to work at R&D should have a knowledge of sustainability . . . it cannot be a requirement. On the other hand, we as a company can ensure that they are educated and ensure that they become more aware . . ."<br>• "It's not established yet, but it is my wish to have obligatory education for sustainability for R&D, within circularity, good material choice and so on" | • "We are not yet there with the circular fully, but I mean absolutely this circular design space is a target"<br>• "[In] China like we do, and they have a different view on . . . for example, maybe they use words like recycle in a way that we would not use the word recycle"<br>• "We have had some meetings with our development department and so on and they understand that this is what they have to work with"<br>• "Our idea is that we are . . . making an educational material [that] we will educate in groups and departments" | • ". . . we can take Sweden or the Nordic countries as an example, . . . But it is not [Company C] as a whole, but some countries have gone a bit ahead"<br>• ". . . as I said . . . we are also a bit of a beginner in this because we work and think a little more circular, so to speak then. And there we are not really there yet in all parts"<br>• "It would be nice to understand that all the products, which is the impact of our products starting really from the scratch?" |
| Shaping industry | • "The [governmental institution] has a network, a sustainability network, where I participate . . . there I will hopefully make contacts . . . a network with other companies who can learn from each other, and their business development programs" | • "The question came up regarding circularity and circular business models and standards ISO is working with, so we are part of it" | • "We are part of a collaboration project together with competitors to develop a standard that is valid for the whole industry"<br>• ". . . there has been interest also from the European Union to create a harmonized common standard for [product]. We are part of that, then we will come together with the big manufacturers" |
| *Aggregate dimension leveling up stakeholder engagement* | | | |
| Manage need | • "It can actually come from our owners, . . .there can be a pressure from them also to start with sustainability work"<br>• "Shareholders . . . have a fairly clear trend right now with ESG issues . . ."<br>• "We got in the stakeholder dialogue that they [the suppliers] want a clear picture of requirements - . . . it feels like we have failed to communicate what way we are on"<br>• "We work quite a lot with a modular architecture . . . mainly to be able to have a customer-oriented product offering" | • "There are a lot of requirements from our biggest customers and that is mainly in regard to circularity"<br>• "[We] can suggest new things to customers, but often recycled products do not hold up" | • "We also look at which stakeholders we have and what requirements they have"<br>• "We are also considering in choosing our suppliers not only the price per piece but also all the aspects"<br>• ". . . we know that no one is really caring about the environment, so but then they all care about the money" |

(*continued*)

**Table A1.**

| Coding categories | Company A | Company B | Company C |
|---|---|---|---|
| Interact | • "Dialog with supplies that they understand and accept it … next step that they are getting more proactive and need to improve their efforts … [it is] not enough to have a signed code of conduct, but they need to show how they work with these questions in their daily work"<br>• "I think collaboration, to find new solutions is working best in cross-functional settings" | • "We have someone that works with customers to find sustainable material, meaning recyclable circular material"<br>• "… we had a workshop with a big customer that came down with designer and sustainability engineering and we have tested different materials … it was a good meeting, it takes a half a day for everyone, but it's you get to know the customer better and it's easier then to have a call and talk" | • "… we have to use our suppliers also to be good in certain areas. So there we have had and will have a bit of cooperation with our suppliers"<br>• "And then we made a collaboration with [company] and are still working with the aim of actually producing a road map for us, for R&D what we are going to work with" |
| Learn with and from | • "It is very important for R&D to develop knowledge and understand that we need already in the development circularity …"<br>• "Just talking about circularity people are start to ask, what does circularity mean?"<br>• "When it comes to suppliers, it's very much about [Company A] having to provide them with sufficient knowledge" | • "A project we started is to look at circularity and find business models or a road map or strategy and maybe start a pilot project"<br>• "We are part of a network … there we can participate in seminars and educations"<br>• "Because just the name, just talking about circularity, the people start with that but what is circularity? What is meant by that?" | • "We cannot pretend to be super specialist in every technology, every aspect, impacting on sustainability. So, I think we need to develop more and more our capability to be open to the external solutions, to suppliers"<br>• "When it comes to the other part, which means life cycle assessment, which means circular material, recyclability of material, here we are more in contact with an external company to train us how to do that"<br>• "Meaning that clearly to use a recyclable material we can also take that from a supplier. But we need to do it in a structured way, and where is that? So, in order to provide, let's say, structured output on selected units and here we are taking competence from outside" |

**Table A1.**

**Corresponding author**
Lea Fobbe can be contacted at: lea.fobbe@hig.se