



<http://www.diva-portal.org>

Postprint

This is the accepted version of a paper published in *Business Strategy and the Environment*. This paper has been peer-reviewed but does not include the final publisher proof-corrections or journal pagination.

Citation for the original published paper (version of record):

Arekrans, J., Ritzén, S., Laurenti, R. (2022)
The role of radical innovation in circular strategy deployment
Business Strategy and the Environment
<https://doi.org/10.1002/bse.3108>

Access to the published version may require subscription.

N.B. When citing this work, cite the original published paper.

Permanent link to this version:

<http://urn.kb.se/resolve?urn=urn:nbn:se:kth:diva-312427>

The role of radical innovation in circular strategy deployment

Johan Arekrans  | Sofia Ritzén  | Rafael Laurenti 

Department of Machine Design, KTH Royal Institute of Technology, Stockholm, Sweden

Correspondence

Johan Arekrans, Department of Machine Design, KTH Royal Institute of Technology, Brinellvägen 83, 114 28, Stockholm, Sweden.
Email: arekrans@kth.se

Present address

Rafael Laurenti, School of Engineering and Science, Tecnológico de Monterrey, Monterrey, México.

Funding information

EU Horizon 2020, Grant/Award Number: 776577-2; Vinnova, Grant/Award Number: 2020-00713

Abstract

Circular economy (CE) is gaining interest among industrial firms in light of sustainability concerns, and several incumbent firms are integrating it into their strategy. In this study, we scrutinize learnings from three large established industrial firms with a clear CE agenda and that are front-runners in CE strategy deployment. We analyze exploitation and exploration approaches to CE and problematize how these approaches relate to radical innovation, which we argue is critical for achieving CE. Semi-structured interviews ($n = 30$) were used to collect data. We found several issues referring to (1) challenges and approaches to normative management, (2) how the innovation ecosystem is engaged, (3) how goals and metrics relate to CE, and (4) resources and coordination regarding the CE initiative. Overall, current exploitative approaches are favored over explorative, mirroring an undesired imbalance between the two. We suggest several ways to counteract this. For example, (1) addressing existing norms so that they align with the ambitions in CE, (2) actively managing collaboration in the innovation ecosystem, including radically new setups of different actors, and (3) that managers need to carefully consider when and how to use goals and measurements in a circular strategy deployment, to foster both radical and incremental innovation.

KEYWORDS

circular economy, innovation, management, radical, strategy

1 | INTRODUCTION

Businesses have long been advised to find competitive advantages while considering the lifespan of resources throughout the product lifecycle using the innovation strategies of “Reuse, Repair, Recondition, and Recycle” (Stahel, 1982). While these so-called R strategies, suggested over 40 years ago, have been redefined in numerous ways, the number of associated business models has recently flourished and sparked interest among the business community (Geissdoerfer et al., 2020; Reike et al., 2018). This trend largely relates to the growth of circular economy (CE), an economic system in which novel business models re-envision the “end-of-life” concept by reducing, reusing,

recycling, and recovering the materials used in product production and use (Kirchherr et al., 2017). While CE entails both incremental and radical innovation, past research has argued that stopping the depletion of natural resources and reducing current levels of CO₂ emissions cannot be achieved by incremental changes alone (Schaltegger et al., 2016). This concern highlights the need for radical measures by many actors in society.

Large established firms play a significant role in the move away from linear production and consumption. They have a significant impact on resource flows, and they occupy a dominant position in supply chains. Furthermore, their long-term existence is critical due to the size of their workforces and their outsized contribution to the

This is an open access article under the terms of the [Creative Commons Attribution-NonCommercial-NoDerivs](https://creativecommons.org/licenses/by-nc-nd/4.0/) License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2022 The Authors. Business Strategy and The Environment published by ERP Environment and John Wiley & Sons Ltd.

welfare of regions and countries. Considering the organizational resources they possess, large established firms also have an opportunity to become leaders in sustainable innovation by taking an active role in shaping how the transition from linear production takes place (Brown et al., 2019). Furthermore, original equipment manufacturers control early product development choices which affect the feasibility of several R-strategies, thus both an enabling factor and a competitive advantage in a CE specifically (Lieder & Rashid, 2016). However, acting on this opportunity is a significant endeavor. CE will entail new regulations (Technopolis Group, 2016); require changes in product-service systems, supply chains, and customer behavior (Lieder, 2017); and need innovative business models (Bocken & Ritala, 2021). These changes put business-as-usual for established firms into question (Frishammar & Parida, 2019). Specifically, firms with a value proposition coupled with physical goods may be particularly challenged in this regard, as their linear production of goods consumes a significant amount of materials and energy (Rashid et al., 2013). In turn, this emphasizes the need for change compared to firms with intangible value propositions (e.g., service providers).

Despite this business potential and urgency of change, there are persistent gaps to be filled. First, we still lack examples of incumbent manufacturers fully transitioned to circular business models (Kirchherr & Santen, 2019). This fact has also inspired several researchers to study the barriers to a CE transition (Kirchherr et al., 2018; Sopjani et al., 2020). Notably, the challenges they have highlighted can primarily be categorized as technological, regulatory, and social barriers; however, less attention has been paid to the internal challenges that firms face when adopting CE (Araujo Galvão et al., 2018). This lack of attention is surprising, considering that supporting a CE transition through innovation is a complex challenge for organizations that involves many different actors, networks, and organizational structures (Sehnm et al., 2021). Implementing a concept that reconceptualizes current linear product development processes, business models, supply chains, and manufacturing technologies requires radical changes for most manufacturing firms (Rashid et al., 2013). Second, we still lack case studies and empirical data on how incumbent manufacturing companies can achieve such radical circular innovations. However, there are multiple known approaches and strategies that companies can adopt in reaction to a need for change or in actively leading development. How companies manage innovation plays a significant role in how firms handle major social and technological shifts and impacts whether they ultimately benefit from these shifts, or get left behind (Christensen, 1997). Concerning resource depletion and the unsustainability of current manufacturing practices, the question of how manufacturing companies act is not just a matter of competitiveness, but societal welfare as well. Therefore, it is crucial to understand how manufacturing companies can guide their innovation work to deliver radical CE innovations. Researchers such as Ferasso et al. (2020) have called for more empirical research on this topic, stressing that we have limited understanding of the conditions that facilitate or impede the implementation of circular strategies, and contribute to their success.

A particular challenge that many large and established firms face is that the existing core capabilities that sustain the business can entrench the status-quo, creating rigidities that impede the development of novel products and services (Leonard-Barton, 2011). With time, it is perfectly normal for firms to develop path-dependent routines, strategies, and resources, which creates a bias against radical innovation (Teece, 2007). To break free from such entrenchment requires being open to new collaborations, drawing on more sources of innovation, integrating across areas of competence, and experimenting with technology and business models. It has been suggested that firms need to develop dynamic capabilities, that is, the ability to integrate, build, and reconfigure internal and external competencies to address a rapidly changing environment (Teece et al., 1997). Dynamic capabilities specifically for sensing and seizing opportunities strongly relate to the theoretical perspectives of exploration and exploitation, where some even argue that they can be equated (e.g., Birkinshaw et al., 2016). Originally, however, March (1991) related the concepts of exploitation and exploration to the management of knowledge in firms, and later research has described the challenges that firms face in balancing the two, since their activities compete for the same limited set of resources and attention (March, 1991; Tushman & O'Reilly, 1996).

Inspired by Ferasso et al. (2020) and highly motivated by the role of large, established firms in society, this study focuses on the strategic integration of CE. We studied three large, established firms in Sweden that are of particular interest because they have defined sustainability strategies that include clearly communicated and high ambitions regarding CE. In other words, we perceive them to be front-runners in adopting CE, even if they are not unique from a global perspective. In line with the recent observation by Santa-Maria et al. (2021), we also believe that the current development of theory regarding CE and organizational change is still in a nascent stage. Therefore, deeper insight is best gathered by studying practitioners in greater detail. Furthermore, we believe that through the strategic integration of CE, firms signal an ambition to assume a leadership role rather than following others in reducing resource usage. This ambition can be expected to have implications for their innovation management. Consequently, this paper has two aims: first, to describe actions the firms have taken following senior management decisions to adopt circular strategies, and second, to analyze how the deployment of circular strategies relates to organizing for exploration and exploitation as means to be competitive in the short term and deliver radical innovation in the long term. As a result, this paper contributes to our understanding of innovation work that incumbent firms are undertaking in light of CE, and the means to accomplish circular strategies by exploiting existing value deliverables and exploring radical innovation.

2 | ORGANIZING FOR CE AND RADICAL INNOVATION

Innovation and technology development are thought to guide organizations in a transition toward a more sustainable society. However, few companies succeed in integrating and implementing sustainability,

especially when moving from a strategic level to an operational level (Hallstedt et al., 2010). While CE should not be viewed as a panacea for sustainable development, it is often viewed as one of several other solutions promoting a sustainable system (Corvellec et al., 2021; Geissdoerfer et al., 2017). This view is especially true in the business community, which has been active in driving and shaping the concept of CE (Korhonen et al., 2018). Perhaps consequently, several research papers on CE and management are practitioner-oriented and pragmatic. Typically, these define processes and tools that enable organizations to initiate and implement a transition to a CE (e.g., Brown et al., 2021; Konietzko et al., 2020). For instance, Konietzko et al. (2020) is a recent example of a recipe for circular ecosystem innovation that adds the important insight that circular innovations are not simply internal to organizations but are part of ecosystems of actors in society. They propose a set of principles relating to collaboration, experimentation, and platformization to facilitate circular innovations as systemic properties rather than individual products. Regarding collaboration, one factor they emphasize is that strategies and goals need to be developed jointly with partners to create alignment (Konietzko et al., 2020).

The number of studies linking the business model literature to CE has also increased significantly (Diaz Lopez et al., 2019); this body of work describes characteristics and frameworks for how circular business models should be developed (e.g., Frishammar & Parida, 2019; Geissdoerfer et al., 2020; Pieroni et al., 2019). Here, business model innovation is viewed as a lever to implement CE at the organizational level, effectively challenging core business logic and aligning incentives among different stakeholder groups (Geissdoerfer et al., 2020). While all changes toward resource efficiency are arguably relevant, circular strategies are thought to push beyond incremental changes and contribute to more systemic and radical changes (Nußholz, 2017). As such, achieving circular strategies often requires considerable business model innovation.

There are two noteworthy nuances in how business model innovation is viewed: either as a source of competitive advantage in itself, or, as an enabler of strategic changes in innovation processes (Pieroni et al., 2019). However, while several papers emphasize the need for firms to make strategic choices when transiting to CE on a general level, many seem to view business model innovation as an isolated process, separate from strategy implementation. Notably, the review by Pieroni et al. (2019) describes how failure to integrate normative management and change management into circular business model innovation could hinder the impactful application of the many methods and tools for business model innovation that are being developed. Looking at the broader scope of corporate sustainability, Baumgartner (2014) suggested a framework addressing normative management, strategy management, and operations management for developing an organization into a sustainability actor. Normative management includes corporate vision and policy, corporate governance, and organizational culture. Similar to the note by Pieroni et al. (2019), Santa-Maria et al. (2021) found that change management and organizational inertia remain underexplored in addressing the complex challenge of innovation toward sustainable and circular business models.

This challenge should not be underestimated from a practitioner's viewpoint. For example, in their multiple case study on barriers to and drivers of CE, Tura et al. (2019) highlight changes in structure, strategy, CE-supportive culture, and flexible decision-making as driving forces while they identify incompatibility with linear goals, conflicts with existing business culture, and the fear of risk as significant obstacles.

Some recent research has specifically articulated the need to actively lead organizational change to enable the transition to a CE, including the need for fundamental change within the organization. Hofmann and Jaeger-Erben (2020) argue that circular business model innovation requires both organizational skills and technical competence, noting that the organizational skills required exceed those needed for more traditional efforts to increase efficiency. They believe this stems from the high degree of complexity in this particular transition. Among other things, the authors suggest the need for internal experimentation linked to the company's "usual" way of testing, negotiating, and reflecting, but which at the same time should be able to take place independently of ordinary operations. Hopkinson et al. (2018) stay on a more general level and notes that innovating circular business models creates a special dynamic that requires the management of tensions, challenges, and trade-offs in the organization and its surroundings. Ultimately, this highlights the need for an organization affected by technology shifts and societal changes to be able to adapt and transform. Arguably, it is a challenge that will entail exploiting known assets and exploration of new ones, requiring active management of innovation.

An emerging stream of investigation that bridges CE and innovation management uses the theory of dynamic capabilities (e.g., Khan et al., 2020; Prieto-Sandoval et al., 2019; Sehnem et al., 2021). Dynamic capabilities is an accepted concept in the innovation management literature, referring to an organization's ability to integrate, build, and reconfigure internal and external competencies to address a rapidly changing environment (Teece et al., 1997). Such resources include infrastructure and the knowledge and abilities of the employees. According to a resource-based view of firms, dynamic capabilities are critical for maintaining competitiveness, with the assumption that technology and product innovations are, in contrast, easier to copy (Barney, 1991; Teece et al., 1997). For example, Prieto-Sandoval et al. (2019) use Teece et al. (1997) definitions of the main groups of dynamic capabilities to formulate capabilities that companies need when implementing CE: for example, in order to *sense opportunities*, a firm needs to be able to make stakeholder information available, in order to *seize opportunities* it needs to be able to establish a "green" culture, and in order to *maintain competitiveness*, a firm needs to be able to reshape business models in the direction of sustainability. Another example is Aminoff and Pihlajamaa (2020), highlighting the need for organizational learning, another critical innovation management issue. They prescribe profound changes and argue that single-loop learning is not enough; instead, the switch to CE requires both double-loop and triple-loop learning. This argument is interesting, considering that an organization's capability for innovation depends on its ability to learn (Wheelwright & Clark, 1992).

Fundamentally, organizational activities relating to learning and knowledge management can, according to March (1991), be divided into two distinct categories: exploitation and exploration. Exploration involves refining and using existing knowledge and skills to make existing products and services more efficient and reliable, while exploration involves discovering and acquiring new knowledge and skills to achieve product novelty and diversity that satisfies emerging markets (March, 1991). Rethinking development work and creating high novelty (such as in product design and business models) requires being attuned to new influences and setting up meetings across competence areas (Levinthal & March, 1993). Furthermore, it requires encounters between people, an influx of new employees, experimentation, and the search for new knowledge beyond the firm's current environment and context (Jansen et al., 2006). Notably, early research emphasizes the contradictions between exploration and exploitation. However, Lavie et al. (2010) argue that while these two strategies may differ in terms of the actual activities they entail (and thus in their supporting structures), there is also a positive interdependence between them. In other words, exploration may strengthen exploitation and vice versa.

Several managerial issues need to be considered in relation to achieving both exploitation and exploration, and one such issue is resource allocation. In other words, organizations must allocate resources to incrementally innovate their value propositions and seize present opportunities, and, to deliver value that meets new requirements and expectations to remain relevant and create new opportunities. A commitment to both may be challenging to achieve, as dedicating resources to exploitation activities is associated with more certain and short-term returns, while exploration is less stable and geared toward longer-term future returns (He & Wong, 2004). As such, pursuing exploratory innovation may be a financial drain during short periods of competitive rivalry. However, it might also be the only way to establish new markets over extended periods of competitive rivalry (Levinthal & March, 1993).

A second managerial issue concerns whether an organization's structure or individual capabilities should be the main mechanism for achieving both exploration and exploitation. One common approach for setting the focus on exploration is establishing a structurally independent unit that focuses on new businesses (O'Reilly & Tushman, 2004). In contrast, Gibson and Birkinshaw (2004) introduced the idea of contextual ambidexterity, discouraging structural changes and suggesting that organizations enable individuals to devote their attention as they see fit instead, focusing on either exploitation or exploration. Lavie et al. (2010) points out the different roles and challenges of each approach. For example, contextual ambidexterity requires managing contradiction within organizational units, while structural differentiation requires coordination across units and handling tensions at the senior management level.

A third issue relates to managerial controls. Jansen et al. (2008) suggest that shared vision, common values and aspirations, and collective goals are crucial for achieving both exploitation and exploration. Their study also highlights the importance of reward systems that favor overall firm performance (i.e., a shared fate) rather than creating

tensions between rewarding exploration or exploitation. Concerning this, managers must also be conscious of how they control their organization through performance measurements. For example, situations with high uncertainty (as in exploration) pose numerous possible outcomes with unknown probabilities. Deploying highly specific measurable goals before sufficient knowledge has been built may damage the processes of gathering that very knowledge (McGrath, 2001). Ethiraj and Levinthal (2009) also underscore the problem of conflicting goals, finding that asking managers to pursue conflicting goals caused a lock-in effect that favored the status-quo. As such, a key challenge is to design effective strategies to deal with multiple goals.

2.1 | Aim and research questions

An increasing number of industrial firms have adopted the concept of CE, and the emergence of CE in practice is helping to drive the transition to societal sustainability. However, we still lack empirical knowledge on how large and established firms, being key actors in this transition, manage innovation work when deploying circular strategies. Based on previous observations, we assume these firms need to develop innovation management tactics that combine exploitation and exploration when deploying circular strategies. Several sources in the reviewed literature also underline this reasoning. First, it is clear that a CE requires significant changes in product design, supply chains, and business models. Second, path-dependent routines, strategies, and resources can create biases against radical innovation in large, established firms. Consequently, we argue that to understand the path forward and the developments that firms need to make, we must analyze CE implementation in relation to the management of exploitation and exploration. Therefore, this study is guided by the following research questions:

- RQ1: How are circular strategies deployed within large, established firms?
- RQ2: How does the deployment of a circular strategy relate to exploitation and exploration in large, established firms, and what are the implications for radical innovation?

These research questions are complementary, meaning that we needed to investigate and describe what the firms are doing and why (RQ1) in order to analyze the narrower perspective of managing exploration and exploitation (RQ2). We expect the answers to these questions to contribute to an increased understanding of the internal work being done by incumbent firms as they integrate CE as a strategic issue. We intend to give a rich and descriptive narrative description of the selected cases. We argue that this will be valuable for practitioners facing similar challenges in their transformational efforts. Furthermore, we expect this study will offer greater insight into how and why firms do or do not organize for radical innovation in light of sustainability issues and will lead to the discovery of new avenues for future development of the theoretical foundations we employ.

3 | METHOD

3.1 | Research design

This exploratory study is based on the multiple case study method (Yin, 2002), using both within-case and cross-case analysis to find patterns, similarities, and contradictions. We apply an inductive approach to describe what actions large and established industrial firms take when adopting CE as a strategic issue. The study is exploratory in the sense that it studies a current phenomenon whose nature is not entirely understood (Yin, 2002). Furthermore, it is inductive in the sense that it aims to identify and build an understanding of an observed phenomenon in practice rather than testing a developed theoretical framework or theory (Eisenhardt, 1989). Considering the exploratory nature of the research questions, together with a limited amount of existing theory, we considered the qualitative case study methodology to be the most applicable, using semi-structured interviews to gather our data (Creswell, 2014; Yin, 2002). Case studies are also commonly applied in CE research on a micro-level (Sopjani et al., 2020) and are conventionally used in organizational research in general (Cassell & Symon, 2004). One characteristic of such studies is that they yield contextual information and rich details, an outcome that is well-suited to our study aims (Flyvbjerg, 2006). In comparison, quantitative methods would not allow for the same level of descriptive detail as interview data, nor would they have the same level of flexibility that can be achieved when collecting and analyzing data concurrently. Morse et al. (2002) suggest that the flexibility of concurrent data collection and analysis increases reliability and validity. Furthermore, the number of firms that have acknowledged CE as a strategic issue limits the sample size that could be achieved in a quantitative approach.

3.2 | Data sample

We selected the three cases included in this study using a purposive sampling technique, identifying cases that would meet our research objectives using our informed judgment (Saunders et al., 2009). Purposive sampling is widely used in qualitative research to identify and select information-rich cases and make efficient use of limited resources (Palinkas et al., 2015). We believe this technique was most suitable for the study at hand, given the research aim of gaining rich information, that is, aiming to learn a great deal about how a small set of firms have adopted CE as a strategic issue rather than aiming for representativeness or randomization in the sample (Emmel, 2013). We selected the three cases based on three inclusion criteria whose logic follows the reasoning of theoretical sampling, as explained by Eisenhardt (Eisenhardt, 1989). In other words, given the available theory, we believe that these cases merit in-depth study, as they can provide detailed insights, and we believe they can replicate or extend emergent theory on organizational change in large firms in connection to the deployment of CE strategies.

For inclusion, each organization must first have formally acknowledged CE as a strategic issue. We confirmed this by discussing it with

company representatives and examining public information such as sustainability reports, official websites, and press releases for mentions of CE ambitions. Second, each organization must be considered large (i.e., over 500 employees) and well established in their respective markets. This criterion reflects our research interest in the specific challenges of managing organizational change, influenced by the size, age, and success of a firm (Tsang & Zahra, 2008). This criterion was confirmed using publicly available information. Third, the companies' main value proposition had to be coupled to physical goods, that is, the companies offer physical products whose design and production they control. We believed this criterion would put a larger emphasis on the need for change in comparison to companies with intangible value propositions (e.g., service providers).

As this is an exploratory study, we strove to capture many different nuances and therefore chose not to limit our sample to a specific industry. While certain characteristics, such as customer segments and product types, do shape the results of our study, the sample is too small to be representative. Furthermore, all the chosen cases have their headquarters in Sweden. The location was a convenience factor (minimizing language barriers and facilitating physical meetings), and we also believed it would lower the barrier for discussing sensitive matters such as strategy and company culture openly with the Swedish research team. Regarding the latter point, we also choose not to disclose the company names in this paper. Instead, we introduce the labels "Transportation"—a vehicle manufacturer, "Forestry"—a forestry products company, and "Tools"—a tool manufacturer.

3.3 | Data collection

The researchers conducted 30 semi-structured interviews at the three companies, lasting approximately 55 min each. We put together an interview guide containing 20 different questions, see Appendix A, starting with questions about the company's and respondent's relation to sustainability and CE in broad terms and then narrowing the focus toward CE strategy formulation and implementation challenges. The focus on how the company works with sustainability refers to both the relationship between sustainability and CE, and the observation that the "sustainability function" is often put in charge of organizing CE activities in several companies. Consequently, we believe it is important to scrutinize how sustainability work is organized in a broader sense and how it integrates with business activities. To lend further nuance, we also asked interviewees to reflect on how their CE transition relates to managing radical and disruptive innovation, innovation ecosystems, and business model innovation. As Adams (2015) suggests, the interview guide was continuously revised as new insights and ad hoc questions from each interview emerged.

We selected interviewees with the help of key personnel at each organization. According to Morse et al. (2002), an appropriate sample should consist of participants who best represent or have knowledge of the research topic. Thus, our intention, which we shared with the project partner representatives, was to capture insights both from

TABLE 1 General overview of the case companies and interviewees

	Transportation	Forestry	Tools
Number of employees	~50,000	~25,000	~15,000
Business type	B2B	B2B	B2B and B2C
Industry	Automotive, transportation, commercial vehicles, and engines	Forestry, wood, pulp, packaging, and paper	Commercial gardening and construction products
CE strategy	<ul style="list-style-type: none"> • Clear CE roadmap, not yet executed • Most activity so far separate in each division, cross-functional efforts planned • No natural place for CE in the organization, no clear responsibility 	<ul style="list-style-type: none"> • Clear CE roadmap and principles in place • Director of CE, coordinating on group level • Each division drives their own CE roadmap • Leveraging CE opportunities across divisions 	<ul style="list-style-type: none"> • Clear CE goal of 50 circular innovations by 2025 • Each division contributes to the goal separately • New partnerships and business model experimentation in relation to CE
Primary data source	14 semi-structured interviews	9 semi-structured interviews	7 semi-structured interviews
Participants	Mid- and senior-level managers, strategy advisors, business developers	VPs and SVPs of sustainability at the divisional and group levels	Mid- and senior-level managers with responsibilities for sustainability in all divisions and at the group level

individuals who worked directly with the question of CE in the organization and from individuals with considerable insight into functions and activities that a CE transition might influence. Given that varying numbers of people were directly involved with CE at the different organizations, the number of identified interviewees varied between the cases. At the Transportation company, 14 employees were interviewed in 2020, reflecting a variety of roles at different divisions; they were selected based on their involvement in the internal formulation of CE strategy in 2019. At the Forestry company, we interviewed nine employees in 2020 who similarly reflected a diverse range of functions and were selected for their involvement in formulating the company's CE strategy. Finally, at the Tools company, seven semi-structured mid- and senior-level managers, both division-level and group-level, were interviewed in 2019 and 2020. Table 1 presents a summary description of the three cases.

Most of the interviews were conducted remotely using video conferencing tools due to the Covid-19 pandemic and geographical distance. All interviews were audio-recorded and transcribed verbatim.

3.4 | Data analysis

The interview data were coded in multiple rounds using qualitative data analysis software, following a thematic analysis approach (Cassell & Symon, 2004). In the first round, we selected a small, random subset of interview transcripts from all cases to be coded inductively by all three researchers. After comparing coding and discussing what themes were emerging, we agreed on a unified codebook containing data-driven codes emerging from the data and specific structural codes relating to our research goals (DeCuir-Gunby

et al., 2011). In the second round, two of the researchers independently coded a new subset using the codebook. This second round was done to ensure saturation with the codebook and to validate the coding of the main coder. If agreement about the coding was low, we revisited and discussed the data to arrive at a consensual interpretation, as Gioia et al. (2013) suggest. After discussion, no significant issues remained, and we considered the coding was validated. See the final codebook in Appendix B. In the third round, the main coder continued with the remaining interview data and then shared the coded material with all three. After finalizing the coding, we then triangulated the interview data with secondary data, such as company presentations and recordings shared with the researchers, as well as information from public reporting and websites, in order to cross-check details that the respondents mentioned, as Grbich et al. (2008) recommends.

4 | RESULTS

In this section, we present the results from the interviews for each case in turn, before the analysis and discussion where the findings from each of the cases are compared.

4.1 | The Transportation Case

4.1.1 | Setting the circular strategy

The Transportation Case has defined a sustainability strategy for 2025, setting a high ambition of taking a leadership position in sustainable transportation. CE is one of the strategic priorities in this

2025 strategy, branded as “Circular Business” to highlight the business potential of the concept. In a series of workshops with internal and external experts, the company defined its desired future state and identified its strengths, weaknesses, opportunities, and threats, both in the present state and desired future. A large part of the investigative work entailed taking inventory of existing projects and methods at the company that were aligned with CE. In this process, they found that the company had launched several pilot projects experimenting with new business models and taken other measures as well; however, it did not conceptualize them under the label of CE or effectively communicate them internally. Furthermore, interviewees felt the company's strong history of Lean production and product modularization held promise to enable further work with CE, both in regard to both organizational culture and practice. In other words, the language of CE was new, but several scattered components were already in place.

Several interviewees explained that their CE ambitions related more to their company vision 10 years in the future rather than to present-day operations. They described the transportation industry, with its several major incumbent competitors, as traditional and as having experienced few major disruptions. However, according to a senior strategy advisor, the industry is currently shifting and is in a disruptive period, requiring several actors in the industry to undertake major changes. Specifically, participants identified connectivity, autonomous driving, and electrified vehicles as trends shaping the company's strategy formulation and business model. In this shift, they saw CE as containing a relevant set of tools for ensuring business viability and using products differently, and a way to strategically differentiate the company in the future market. Consequently, CE will require new core competencies and create major tensions with current processes, methods, and principles. As one interviewee explained, there is low-hanging fruit, such as increasing recycling in current operations, but long-term ambitions will need to go far beyond this. It will require radical technology innovation but also innovated business service models such as Vehicle-as-a-Service or Transportation-as-a-Service.

4.1.2 | Deploying the circular strategy

Several interviewees explained that CE has not yet been defined properly, with clear goals, nor has it settled in a natural place or secured dedicated resources within the organization. Here we can see two perspectives among the interviewees: one stressing the danger of setting the wrong goals in exploratory stages, and the other emphasizing the organization's need for clear goals to enable a shift, lest goals associated with the traditional linear business model remain entrenched. Both perspectives were summed up neatly in the quote by the respondent below:

I believe in making things that are big and strategic by putting clear goals. Goals which are a bit more challenging than what the engineers feel comfortable with.

Those parts are cornerstones in a good transformational journey. [...] we realized after a while that we would not be able to set proper goals on the circular part because we have not gotten far enough. So if we set goals, we will set sub-optimal goals. You could set up goals for average recycle rate or something, but then people would cheat. We need to find goals that actually mean something and that are good enough to move us forward in this journey. I have not found those goals and I am not very impressed by what I see other companies targeting in terms of circularity.

Interviewees frequently saw the company vision and clear dedication of senior management as playing a major role in the current lack of clear goals at this stage. Some interviewees felt that putting a strategic emphasis on CE enabled cross-functional attention on the matter. However, others explained that most of the activity had been done in separate divisions. Some explained this as a natural sense-making stage, and felt the concept would need time to mature in each function before achieving its true potential. To date, most of the coordination has been organized by one key individual operating outside of their normal scope of duties. While most of the respondents were clear that this was a strategic question, some felt the lack of dedicated resources indicated senior management's lower prioritization of CE. Furthermore, some believed that this lack of coordination was particularly harmful to CE strategies, explaining that since the concept of CE is built on flows involving several areas, a lack of alignment across those areas risks a sub-optimal implementation. In particular, this relates to the transformational circular business models, whereas smaller, incremental achievements could be achieved with less coordination and built upon existing processes, structures, and functions.

Since CE is about flows, perhaps there could be sub-optimization if we here at [my function] look at some solutions, and then other people are looking at other solutions more connected to recycling. Then maybe ... If R&D is planning something different then ... Then I do not think that you can make a loop happen. So, I definitely think there is need for coordination.

When comparing CE with previous strategic implementations, one respondent said the new strategy was more transformative and therefore also more challenging to disseminate in each area of the company. They highlighted several dangers in this. For one thing, moving too slow would mean investments in linearly designed products that would be in the system for a long time, thereby limiting the value that can be reused. Another danger is that a transformative strategy might mean more centrally led activities, harming local creativity and operations. In contrast, the company's decentralized sustainability organization has historically been preferred over centralization, and has proven effective according to respondents.

We are fairly rigid in our functions. We try to ... It is one of our major challenges in this new transformative strategy [...] We realize that we cannot break the strategy down on each function and then just go with it. And that is what we have always done! So, no, we are not organized for working optimally with transformation.

One respondent described challenges in identifying which of the resources and capabilities that have given a competitive edge in the current organization will be relevant during and after the transformation. Here they particularly highlighted executives and middle management, who have built their careers in the linear system and may be reluctant to change. One respondent said there was also a sense of pride over the accomplishments concerning recyclability of the vehicle. While achievements in recyclability should not be ignored, interviewees also described them as creating a belief that the current setup was already contributing to CE; this made it hard to introduce newer and more ambitious targets.

When we discuss these things with different parts of the system, they get so proud, maybe with some justice. I mean, a car or a truck is recycled to an extremely large extent. [...] Then people feel like “well, there is nothing more to talk about?”. Then, you need to get into these more complicated questions [...] So that's a bit of a challenge then, that people sometimes think that we live in the circular economy.

Several respondents also brought up surrounding actors as factors that had to be considered in transitioning toward CE. By this, they referred to both which actor should *start* the shift, as well as other actors being enablers in different parts of this transition, emphasizing that not all the resources and capabilities needed to achieve CE are found in-house. Interviewees described this as a challenge, considering that the company traditionally has relied heavily on in-house competence and now needs to open up to new partnerships, especially in light of technological shifts and increasing focus on services. In this vein, another respondent highlighted the danger of promoting a transformational vision where existing employees might not recognize their roles.

That is always a challenge when individuals ... I mean, you are an individual and you see that ‘where I work and where I contribute, [compared with] what is being communicated [by top management as the vision], I'm not there’. Then of course that creates concerns and such in the organization.

A number of respondents also brought up examples with product design, stating that current designs often favored assembly processes following Lean principles, as well as recycling. At times, these design choices came at the cost of reduced reparability, as one respondent

stressed. This significantly reduces the value of take-back strategies for vehicles currently being produced, since they are not designed for high residual value and most likely will have to be recycled rather than salvaged for parts or repaired. Consequently, some respondents believed that the CE transition needs to start with the R&D department, given that they control product design and material choices. Furthermore, considering that used vehicles often are sold to low-cost countries where they are hard to keep track of, some respondents pointed out that take-back logistics were not always feasible with the current lifecycle flows.

I mean, we optimize on cost of course, and on all the properties we want the product to have, and for it to be assembled. But I do not know to what extent we design it to disassembled properly. I think that is a major challenge, not only for us. I mean electronics, to say the least, there everything is heading towards smaller and smaller [designs] and harder and harder to disassemble the components.

Several respondents also pointed to a need to change business metrics. Existing, well-established calculations for developing new vehicles take the current business model for granted, while circular business models create new complexities, uncertainties, and risks.

Currently we are trying to force that [new] business model in a traditional vehicle production company, if I'm being blatant. That is how it is. [...]. Then you need to come back to how KPI's, award-systems, [and] evaluations support circular thinking. Because that [way of] thinking is built on the traditional business models.

One respondent explained that there is an immense need to evaluate the business potential of CE using sufficient data and detail to generate credibility, while at the same time, being sufficiently concise and comprehensible to create a clear motivational business case. Another respondent explained that it has historically been challenging to justify more sustainable processes or machinery (for example) versus cheaper alternatives. A third respondent explained that performance is currently connected to vehicle registration data and new vehicle deliveries, incentivizing putting more trucks on the market rather than increasing their utilization. While there are metrics for, for example, spare part sales and aftermarket services, these figure less prominently in decision-making. Other respondents added to this by pointing to “internal cannibalization,” where cosmetically defective vehicle parts compete with the manufacturing of new spare parts. Some participants brought up the issue of delivering premium products in this regard, which means the company has less leeway to offer refurbished “scratch and dent” parts or to use new materials whose properties are not as well-known as those of existing materials.

4.2 | The Forestry Case

4.2.1 | Setting the circular strategy

Interviewees in the Forestry Case reported a shared view of their company, describing how their work with renewable raw materials has established sustainability as the center of their offering to the market. They relate to a sustainability agenda with clear targets and goals. In 2018 the company appointed a “Director of Circular Economy,” responsible for coordinating CE across the entire Forestry corporate group. The starting point for this director was to find missed business potential and highlight cross-divisional opportunities in CE. To structure the work and give strategic guidance toward the circular bioeconomy, the company developed a CE roadmap broken down into Circular Design, Circular Value, and Communicating Circularity. These three areas are coordinated at the group level, and divisions implement specific initiatives to (1) create value through new circular pilot projects and partnerships, (2) integrate CE into design and innovation, and (3) build internal and external awareness and culture of circular thinking.

And we are looking at new areas where you could actually ... where traditional pulp has not been used as a raw material. We are trying to tap into those as well, to see that. If there are opportunities for more bio-based material. And all of the emerging businesses that we are working with in the innovation center, they are all disruptive innovations. They are really going new products into new markets, things that have never been tried before.

Most respondents shared the view that CE is a key strategic issue clearly supported by senior management and highlighted in company strategy. However, they offered different perspectives on how the company relates to CE. One group of respondents viewed CE as nothing new, per se. Instead, they emphasized the idea of a circular *bioeconomy*, referring to the role the company already plays in offering renewable materials.

But basically, our strategy is to be more circular and drive circular bioeconomy forward. And that's where the big picture comes from, and then in action, we have things like circular economy road map that support getting there.

Another group recognized this material aspect but added the consideration of new circular business models that include product take-back and reuse and associated changes in product design needed to allow this.

[...] together with our other divisions, we are trying to penetrate how to work smarter with these concepts. Recycling, reuse, and the others that are central in the

circular work. There, we work from the very top level to try and find business opportunities in these areas. [...] Circular design for example, how to work with innovation and new products.

These two perspectives in the organization were clearly creating alignment difficulties, as explained by one interviewee:

I think that so far, the major challenges [is] that [CE] is kind of everywhere and nowhere. That circularity is so relevant to our industry, and actually, one of the main challenges is that we see that renewable material as such is about circular procurement and circular operations. And that with that, we are always dealing with circular products. [...] it's internally a little bit difficult to navigate the discussion of becoming better while already being good.

Since the company's divisions offer diverse products, there are differences in customer demand for circular offerings. Most evident is the demand from customers who offer sustainable consumer products or have compliance concerns. As such, Forestry's role is often to provide materials, products, and services that help its customers achieve their sustainability goals. Therefore, the increased efforts in CE have often entailed a close collaboration with business customers or end consumers. One respondent also described this as a shift in mindset, that the company has increasingly considered which customers they want to work with as it searches for a shared agenda for innovation, CE, and sustainable products that are considered important to achieve its sustainability agenda.

Although environmental sustainability has arguably been at the center of Forestry's value proposition for many years, some respondents described a shift in the importance of and perspectives on sustainability. From the traditional baseline of license-to-operate (e.g., forestry is an industry under heavy public scrutiny), the company has moved toward delivering a different value to customers that other suppliers cannot—a strategic advantage. One particular division exemplified this shift, finding itself in a more disruptive period than others. Specifically, respondents from the paper division explained that they had a challenging period following declining demand (due to reduced newspaper circulation and lower demand for printed paper). However, they described CE and sustainability as giving their company's products a competitive edge, enabling value propositions other than simply product performance or low price.

Of course, every division has their own kind of drivers. But of course, we struggle quite hard in paper division for our kind of survival. [...] we have some mills closing, some machines... Others are converting to something else. So we need to struggle quite hard to be successful for the future. And then I think everyone understands that, as said, this sustainability is a competitive edge and circular economy is a competitive edge.

One respondent went even further, articulating a belief that within 10 years, it was likely that the majority of revenue would come from circular products. However, to reach that point, circular innovation's current cannibalization of the main business would need to be managed. The respondent described such issues as becoming increasingly prevalent, and critical strategic decisions will be required. Other respondents hinted at similar potential disruptions, emphasizing the role of strategy in light of difficult choices to come.

4.2.2 | Deploying the circular strategy

Interviewees described differences in how far the different divisions had come in their CE ambitions. For example, waste streams from mills are well-managed, and processes such as product renewal include consideration of CE principles. However, other areas, such as forest management and reuse of consumer goods, had not been sufficiently considered yet. One interviewee commented that most divisions were in an early stage of CE implementation in general. The differences in resources among the divisions was brought up in this regard, where one of the smaller divisions found it difficult to dedicate resources to CE projects. However, progress toward CE was enabled in this division by leveraging CE initiatives undertaken at other divisions with shared customers.

[...] we can leverage a little bit from the other divisions that are partly doing some similar things that part of our customers. That's why I think that we have a little bit of an internal urgency that we want to look into that [CE]. But on the other hand, then we are the smallest of all the divisions, so we also have the resource question that ... how do we actually tackle that, and how do we get going and where do we find the resources to do this?

Currently, the company has no set of clear CE goals. Several interviewees commented that the timing had not been right to set such goals yet. Instead, they felt it was important to see how CE fit within the overall business strategy and formulate goals once it matured.

I think we have an initial, working, continuous process, to step-by-step get us there. Taking us in the direction towards circularity. [...] but this is iterative, and a process that needs to continue for a long time. And this could also be a threat to that, if we were to bring in strict follow-up requirements and means. Because, then, you get what you measure, but not necessarily the drive for a better system.

Furthermore, a few respondents noted the risk of setting strict targets when CE was not sufficiently defined yet, thereby risking setting the wrong targets (i.e., sub-optimization). However, others also mentioned the consequence of this lack of definition—that they

currently were not very incentivized by specific targets. One respondent adds to this, explaining that sustainability work was less motivated by numbers and more by vision and culture, and thus it is always present but vulnerable to employee turnover.

[...] it's kind of inbuilt in the culture which means that it is actually something that is rather sustainable. But at the same time, culture is the sum of the people we have at the moment, and things do change. So I think that it's always ... It's kind of a fragile set up if you do not have a strong basis for really driving with the goals, I think.

In addition, setting relevant goals is dependent on regulations. For example, a requirement for a certain percentage of recycled material in a product would depend on the sufficient availability of uncontaminated material. This means that plastics derived from fossil-fuel could unintentionally be favored over renewable materials.

Several respondents commented on the need to evaluate economic performance, material properties, and the environmental impact of circular business several respondents. For example, the reverse logistics required could increase CO₂ emissions, circulating the wrong material could lead to poor product performance, and it is currently difficult to show the economic incentive of circular business strategies. In contrast, existing goals and metrics were described as heavily focused on financial aspects and often neglectful of sustainability goals.

Interviewees mentioned the company's scale as adding to the complexity of coordination. For example, making sure that relevant information reaches the right people in the organization, and evening out knowledge levels in the company. Several respondents also noted differences in the local infrastructure and regulations in the countries where the company operates, making alignment challenging, since not all questions are relevant for each market. Furthermore, several respondents pointed to the complexity of the value chain and its dependence on a large set of actors, requiring coordination beyond the organization's borders. This coordination is especially challenging concerning materials, which have a variety of end product usages and complex return flows.

Because there's certain, of course, challenges when we look at markets. So, the markets have good recycling infrastructure and good collection of the packaging from the household level, for example in EU. But that's not the case for all countries.

With regard to driving transformation, one respondent commented that it is human nature to focus on business-as-usual in challenging times rather than taking risks in something more radical. Consequently, they found it challenging to align on transformational circular innovation. Another participant noted a need for a mindset shift that would open up and allow for new collaborations. While customer collaboration is nothing new, the CE projects often involved

collaborations from further along in the value chain or with other actors who saw opportunities in waste created during the course of the process. Some participants felt the scale of current operations in value creation created a reluctance to change or experiment, particularly given the large production volumes of the company's pulp industry. Furthermore, that the current expertise and collaborations all support the main production, making it challenging for value creation in side-streams to get attention.

4.3 | The Tools Case

4.3.1 | Setting the circular strategy

Respondents described that when the company vision was revised in 2017, sustainability received a more significant role in a customer solutions-oriented vision, including both products and service. Consequently, a more offensive approach to working with sustainability was set off, connecting sustainability closer to future business success. Several trends are currently influencing the company's business: technology shifts (such as battery technology, the internet of things, and artificial intelligence), market shifts (such as urbanization and greenspace management in smart cities), and also resource scarcity and climate change. The market shifts also include an identified change in consumer values and purchasing behavior toward more sustainable goods and product sharing, which brought Tools' business model into question. These trends were identified at the group level, influencing every division in different ways and to different extents. One respondent described these trends as a realization that they cannot expand everywhere and keep everyone satisfied, referring to the need for a strategic focus in which CE acts as one of the new guiding concepts.

The development and manufacturing of high-performance gasoline engines exemplifies what has long been a strategic advantage in targeting the premium segment, especially regarding forestry and professional products. According to one respondent, these high-performing engines are difficult to reproduce through reverse engineering. However, competitors are now emerging and offering cheaper and mechanically simpler electrically powered tools, making it more difficult to differentiate based on product performance alone. Furthermore, the company has long relied on vertical integration of its production and supply chain as a strategic advantage. The electrification of their product portfolio creates new requirements for capabilities that the company does not currently possess (e.g., manufacturing electrical motors and batteries), and along with it, the need for new business models.

In general we have quite a lot of competition, especially in consumer goods. [...] And the battery-shift that has occurred these last couple of years ... Going from gasoline to batteries, that makes things easier for competitors to enter as well, because two-stroke gasoline engines are not super easy to say the least. Of course,

many can copy them, but making these high-performance products is pretty challenging, while making a battery product is a lot ... Easier, I would claim, to make those work.

Formally, the work toward CE started in 2019 while preparing the 2025 sustainability strategy, with specific efforts to define what CE is about and its meaning. This resulted in a set of "R strategies" and definitions of these that the organization could relate to, in order to drive innovation work for CE solutions. The group representatives viewed this first step as crucial, since different divisions had different understandings of what CE entailed. It is not a concept that people in the organization had a particularly strong relation to, or understanding of whether or not they already offered circular solutions in the past.

[...] everyone knows that it is something that needs to be on the agenda. But, very few people understand what it means. So I think it will, again, take us a few years to realize what are the opportunities behind and what are the consequences for us in terms of product design, service design or business model design.

However, product repair and service were part of the company's business model, and several local initiatives fitting the R strategies were also identified while formulating the strategy. Thus, some circular innovations were already present, although they were not referred to as such. For example, the company launched product-sharing pilots in selected markets several years ago. These more radical innovations have received continuous support from the management, even if they are not yet established on the market. Furthermore, one respondent described this initial experimentation as resulting in a willingness within the organization to try new things and explore new business models.

One interviewee commented that the new strategy required broadening the horizon and considering the product, customers, and supply chain in a more global way than had been done previously. Furthermore, when formulating the strategy, it was considered key by the group representatives to have a stronger connection between the sustainability strategy and business potential than previously. The group also had a clear ambition to allow the different divisions autonomy in navigating their strategic roadmaps. By including representatives from all the divisions in formulating the shared goals and targets for the group, the aim was to ensure that these would be sufficiently rooted in all divisions from the outset. The company's stated ambition was to frame the new focus on CE as a strategic business opportunity, where integrating sustainability closely with business goals would result in greater managerial attention and prevent it from being treated as a separate issue.

4.3.2 | Deploying the circular strategy

The company's product development process normally takes up to 4 years, and therefore, several decisions for upcoming products were

made before the new focus on CE. Interviewees described a clear internal communication and rollout plan as key to further ensure the integration of CE principles in the product development process in different divisions. These divisions have diverse challenges and prerequisites in their sustainability efforts and do not normally share customers. In turn, this makes the coordination of efforts under a shared set of goals challenging. Furthermore, diverse circular innovation projects need to be evaluated uniformly in order to minimize confusion in internal and external communications.

The interviews highlighted the issue of performance metrics in particular. Several respondents mentioned short-term metrics like profit and sales volumes as particularly harmful to ensuring that attention and resources were dedicated to long-term ambitions. One respondent added that sustainable alternatives are typically more expensive, making it challenging to justify them if they are evaluated purely on economic factors. Therefore, the interviewees emphasized that it was crucial to evaluate circular business models both in terms of business potential and contribution to sustainability goals. They viewed this as a challenge for circular business models in particular, with numerous factors that need to be accounted for (e.g., not only looking at the percentage of recycled material in a product). As such, this creates difficulties in setting relevant goals and KPIs for CE, and the CE transition therefore depends on updates to financial systems and internal project evaluation practices.

[...] we are really a product company. And, we are selling products. Our goal is to sell as much product as possible with a better margin. In that sense, we are really, I would say, in a classical business model approach. [...] we, last year, did a test on this [project name] where we tried to share products and rent products instead of selling it. And this is things which we are trying more and more now. Because, we know that ... The business model that we are running right now will have limits, and we need to bring something new.

Every division described differences in CE opportunities, starting points, and challenges. For example, the small consumer gardening products division was described as having a clear opportunity to replace virgin plastic with recycled since their products have lower performance demands. Another interviewee observed that this relatively small product change had been brought into question previously. However, after initial experimentation, the division now knew that it was possible to meet quality expectations using recycled material, thereby improving their starting point to work on other issues as well.

[Division name] is easier, since we have mainly plastic products and we are working a lot on what type of plastics and recycled plastics, [...] And, it took us one year to put that on the agenda, but now [division name] have it in the strategy, to work on the type of plastic they are using. [...] And even people [who] were

not convinced, that 'This plastic, we cannot use it on our machines' and so on. But it took us one year to demonstrate that it works and, [laughter] Now they say that 'Ok, it works'.

In contrast, the construction tools division saw many challenges in introducing changes to product design to meet CE goals. They explained that this was because commercial users put great value on uptime, and radical changes were viewed as risky. Furthermore, the divisions experienced differences in segmented customer demand. In consumer products, participants had observed a shift toward favoring more sustainable products and associated purchasing behaviors. For government buyers, the public procurement process acted as a driver for setting sustainability requirements. Lastly, the construction segment exerted little pressure toward environmental sustainability at the time. Consequently, this division saw little connection between business strategy and sustainability goals, which employees highlighted as a challenge.

Several respondents described a product-centric mindset and culture since the aim has always been to sell more products. They emphasized a need to consider services and alternative business models, internal training on new methodologies, and new ways of reaching customers. One respondent believed that the company's current use of customer insights was not enough to develop new business models fully. Working with customers to create something radically new was seen as a challenge compared to collecting input for making minor product design changes, for example. In terms of value creation, one thing that the interviewees highlighted as a success factor, as well as a challenge in recent years, was the need to work actively and openly with suppliers. Respondents described the product development process as historically very secretive and handled in-house, but the capabilities required to meet new technology trends had opened up the development process. This opening up was also highlighted concerning how the company works with sustainability: for example, in seeking and establishing partnerships for new circular business models.

5 | ANALYSIS AND DISCUSSION

When CE was been introduced as a question of strategic importance, the companies faced challenges in unlocking two different yet arguably interrelated sets of circumstances. First, they all have had strategies where both business and sustainability are related to a linear logic. Naturally, this creates path dependencies and rigidities in resources, capabilities, and routines that affect daily business. For example, this relates to competencies in design-for-manufacturing and the production of high-performance internal combustion engines, capabilities that arguably would be less important under a circular business logic. Second, as we have argued, CE will require radical innovation and an increased focus on exploration. Facilitating exploration is a well-researched challenge for many large, established firms, where there is a tendency to focus on the exploitation of current

FIGURE 1 Illustration of the findings concerning the integration of a circular economy (CE) strategy

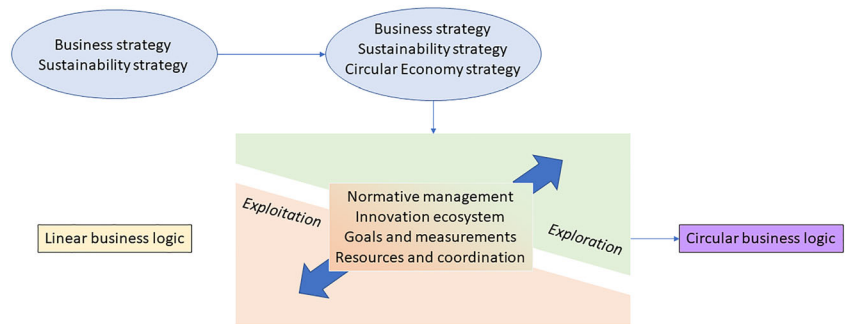


TABLE 2 Analysis of exploration and exploitation at Transportation (A), Forestry (B), and Tools (C)

	Exploitation <i>Existing assets, capabilities, and activities foster improvements to existing products and services</i>	Exploration <i>Venturing into new territory and examining new markets, products, and business models in order to deliver novel products and services</i>
Normative management	<ul style="list-style-type: none"> Lean production system already emphasizes waste reduction (A) Progress in recycling viewed as good enough (A) Not everyone see their role following a transformation (A) Current value proposition of renewable materials viewed as sufficient (B) Challenging times means focusing on what you know (B) Focus on premium product performance hinders experimentation (A,C) Siloed, product-centric mindset (C) 	<ul style="list-style-type: none"> Clear senior management commitment to sustainability and incentives for experimentation (A,B,C) Transformative company vision questions business-as-usual (A) Roadmap for building circular thinking (B) Acknowledgement that current differentiation strategy based on (gasoline/diesel) product performance is no longer viable (A,C)
Innovation ecosystem	<ul style="list-style-type: none"> Product takeback not feasible since products are lost when shipped overseas (A) Dependencies on local infrastructure, actors, and regulations hamper alignment (B) History of preferring in-house product development (A,C) 	<ul style="list-style-type: none"> Need for new strategic partnerships identified (A,B,C) Shared agenda sought with key customers for innovation, CE, and sustainability (B) Need for collaboration further along value chain identified (B,C)
Goals and measurements	<ul style="list-style-type: none"> Goals not yet set, and thus, CE innovation not incentivized (A,B) Existing metrics and project evaluations take current linear business logic for granted (A,C) Challenging to justify more sustainable purchases over cheaper ones (A) Short-term financial targets overshadow other long-term priorities (A,B,C) Difficult to justify radical CE innovation financially (B) 	<ul style="list-style-type: none"> Goals not yet set, leaving room for exploration (A,B) Goals and metrics set to foster ideation on CE (C)
Resources and coordination	<ul style="list-style-type: none"> CE does not have dedicated resources in the organization (A) Difficult to dedicate resources to CE projects (B) Current expertise and collaborations support the main business (B) Scale of operations creates reluctance to experiment (B) 	<ul style="list-style-type: none"> It is clear that CE will entail new competencies (A,C) Pilot testing of new business models (A,C) Director of CE seeks cross-divisional opportunities (B)

business opportunities rather than exploration to ensure future viability (Levinthal & March, 1993). When analyzing the case companies, we found examples of circumstances that favored either exploration or exploitation, and that these examples relate to a large variety of different issues. Using an abductive approach, iterating between empirical data and theory, we also see that the exploitative and explorative activities relating to deploying a circular strategy can be structured in four major areas: in (1) challenges and approaches to normative management, (2) how the innovation ecosystem is engaged, (3) how goals and metrics relate to CE, and (4) resources and coordination regarding the CE initiative, see Figure 1 below.

We identify and discuss exploitation and exploration issues of relevance to the deployment of a circular strategy (issues directly or indirectly connected to the circular strategy) and problematize how these affect radical innovation work. We specifically address what implications these issues have to achieve necessary radical circular innovations. Overall, we believe there is a lack of explorative activities due to their criticality to radical innovation. However, it is not a linear relation between exploration activities and radical results, but a mutual interdependence between exploitation and exploration. This interdependence is highlighted by Lavie et al. (2010), addressing that exploitation can lead to necessary short-term incomes in order to allow for identifying new opportunities that secure long-term income. Still, a bold strategy that challenges both technology and business models requires experimentation, piloting, and searching for new knowledge that should characterize exploration activities. This analysis is summarized in Table 2 below and further discussed in the following sections.

5.1 | Normative management

There are several examples of existing ways of working that seemingly favor exploitation over exploration, several of which relate to established norms in the companies. Baumgartner (2014) highlights normative management as a specific issue for a corporate sustainability transformation, in addition to strategy and operations management. Indeed, we find that current norms regarding how sustainability is aligned to business do not seem to be particularly challenged, although CE in itself does challenge “business as usual.” Typically, we see a sense of satisfaction for already achieved changes that favor CE, such as reducing waste in manufacturing processes or working actively with recycling. All the cases also offer examples where circular innovation can be achieved through incremental improvements to existing products and processes by extending the organization's existing resources and capabilities. While such achievements and opportunities should not be ignored, it is important to question their implications for pursuing more ambitious endeavors that require exploration.

Other norms that favor exploitation include focusing on product performance and products in isolation from the business model. Both Transportation and Tools feared that their historical focus on offering high-performance premium products would hamper their flexibility to

take risks involved in implementing something new. However, considering that both these cases already have undergone immense changes in terms of digitalization and electrification of their products, they have already demonstrated that they can take radical measures. Consequently, this fear could be seen as a need for a new identity, suggesting that radical circular innovation will require challenging or recontextualizing existing company norms. For example, what does it mean to deliver “premium” value in a new economic logic as CE would entail, where value exchange is the focus rather than product exchange?

In terms of norms that favor exploration, it is clear that both Tools and Transportation have acknowledged that their current business model needs considerable transformation to achieve the transition to sustainability. Transportation emphasizes this need in particular, admitting that their business-as-usual is part of the sustainability problem and therefore requires a major rethinking. Consequently, together with a large portion of the transportation industry, they are envisioning a major disruption in which they can assume a leadership position in sustainable transportation. This is a significant ambition in terms of sustainability and innovation, and places many requirements on the existing business. At the other end of the spectrum, Forestry describes its industry as comparatively less turbulent. Naturally, there are competitors and threats of substitutes, as well as a dependence on shifting legislation, but the general view seems to be that the focus on sustainable development only favors their current business and therefore they feel less of a sense of urgency to change. From this narrower perspective, it is clear that the firm's current capabilities could be sufficient to achieve an incremental transition to CE. Employees at Tools question the current business model, both in terms of threats from emerging competitors and also from a sustainability perspective. However, making significant changes does not appear to be as urgent as it is for Transportation, and the implications of CE on Tools' vision is not yet clear. Consequently, much of the work at Tools involves sense-making, experimenting, and creating alignment specifically on CE throughout the different divisions, whereas Transportation has spent more time finding how CE either fits or conflicts with other aspects of their transformational journey.

Interviewees from all the companies highlighted clear senior management commitment as one key in navigating a CE transformation. At all companies, senior management was described as being generally supportive of CE, having identified it as a strategic question that should receive attention. In general, CE was framed as a component of the companies' sustainability strategies but was not prioritized over other issues, although it was given a different conceptual breadth than other components of the sustainability strategy. On the one hand, given the high levels of ambition and multifaceted challenges involved in CE, we might question whether radical circular innovation can be achieved without strong leadership and prioritization that facilitate this. Contextual ambidexterity is one suggested approach that, in contrast to structural change, acts at the individual level (Lavie et al., 2010). In a system that works through contextual ambidexterity, employees continuously divide their time balancing exploration and exploitation. Gibson and Birkinshaw (2004) argue that promoting this

employee behavior requires leaders to establish organizational contexts that empower employees to make such choices. As one respondent in Forestry commented, in challenging times, it is human nature to focus on what you know rather than to explore something new, pointing to the need for guidance from senior management to achieve innovation in such contexts. On the other hand, it is also challenging for senior management to promote a transformation where not every employee clearly sees their future role, as one respondent at Transportation noted. Furthermore, managers are challenged to unlearn the behavior and routines that have previously led to success both for the company and for themselves in their careers. The context in which they learned these routines may shift, making it risky to emphasize exploitation over exploration. Levinthal and March (1993) refer to this as the role of internal selection, something that one respondent at Transportation hit upon. Organizational unlearning is an interesting avenue for further research mitigating this kind of entrenchment and developing the capabilities and resources that are crucial to a CE.

5.2 | Innovation ecosystem

When considering their relationship to a broader innovation ecosystem, the case companies all appear to have realized that they will need new strategic partnerships and closer collaborations with existing partners and suppliers in order to achieve their ambitions in CE. In addition, respondents from Forestry noted that they sought customers who shared their sustainability agenda in order to foster innovative collaborations to achieve circularity. However, there were few examples of engagement with a broader innovation ecosystem. This could indicate an early stage of a transition, where such an engagement has not yet materialized, or it could be related to the challenges that all the companies appeared to face in opening up for collaboration and partnerships. For example, respondents from Tools and Transportation described a particular tendency to favor closed, in-house product development processes. At Forestry, dependencies on local infrastructure, actors, and regulations had specifically been found to create challenges in creating alignment, both internally and externally. Consequently, the well-established routines of managing supply chains need to be supplemented with more collaborations in new constellations of actors, where there may even be competitors. The latter is an important parameter to consider in establishing new business ecosystems (Moore, 1993). In later research on innovation ecosystems, Visscher et al. (2020) have found that exploration can occur at one level in an innovation ecosystem where many actors are involved, and where exploitation is ongoing on another level with fewer actors involved. Perhaps an image of an ecosystem that also contains collaborations of an exploitative nature can be less challenging than an image of an ecosystem that is entirely exploratory. Thus, this finding can inspire companies to create the conditions for new collaborations. Applied to radical circular innovations, it is likely that a broad involvement of actors is needed considering that closed material flows and new business models also affect customer behavior and public actors.

5.3 | Goals and measurements

The findings on goals and measurements are particularly interesting, as there are clear commonalities and challenges that favor exploitation, and different perspectives on achieving exploration. Frequently described challenges include a focus on short-term financial goals that overshadow long-term priorities, as well as existing project evaluations and metrics that take the linear business model for granted. In terms of setting goals and metrics specifically for CE, we found opposing views within both Transportation and Forestry. It seems unclear how goals and metrics can best be utilized to support a CE transformation. One perspective pointed to a lack of clear goals and measurable performance indicators leading to a lack of clear incentives for CE in the organization. In contrast, others believed that this allowed for the exploration that was required in the early stages of a transformation. The latter group also pointed to the risk of sub-optimization and misguiding the organization if goals and metrics were decided on prematurely. This seems related to McGrath's (2001) warning that specific and measurable goals deployed prematurely may unintentionally hamper the exploration processes crucial to building required knowledge bases. Contrastingly, the various divisions at Tools were expected to deliver on the group's defined goal of 50 circular innovations by 2025. As the initiative is relatively new, it is not yet clear how the divisions will align on this target. However, one of the group's clear ambitions is to foster ideation based on this goal, focusing both on circularity aspects and business potential. In other words, the goal setting acts as a trigger, in contrast to the case of Transportation, where many joint efforts in CE are still stuck in the planning stages.

5.4 | Resources and coordination

While there appears to be a strong commitment from senior management for the sustainability transformation at Transportation, there are gaps in terms of dedicated resources and coordination of CE efforts. Perhaps consequently, most current activities are taking place in separate islands of the organization. In contrast, Forestry has focused on the coordination of efforts through resources dedicated to CE ambitions. As the respondents shared, this supplied additional resources to CE innovation projects and leveraged opportunities across divisions. At Tools, the different divisions are expected to execute their CE roadmaps independently while targeting the group's goal of 50 circular innovations by 2025. Because the initiative is relatively new, it is not yet clear how the different divisions will align.

Our respondents also often highlighted cross-functional collaboration as a requirement for achieving CE innovation, which Hopkinson et al. (2018) also suggest. From a technology perspective in isolation, it is possible that achieving radical circular innovation is not more challenging than other technological innovations. Naturally, there are specific challenges such as the performance of recycled material or suitable design for R-strategies to be conquered. However, it is clear that a systems perspective integrating business and technology is

required for achieving such innovation in the different organizations. While the need for coordination perhaps comes as no major surprise, we found an interesting implication from this in the case of Transportation. There, respondents viewed the lack of coordination as hampering the development of radical circular innovation, although incremental circular innovation could be achieved without the need for coordination or any major changes in structures or methods. Thus, it appears that the issue of coordination favors incremental innovation rather than radical innovation. Consequently, structurally separating exploration and exploitation may not be a feasible approach for industrial incumbents to achieve radical circular innovation. It is therefore relevant to look for other means to achieve both exploration and exploitation, relating to the earlier discussion on contextual ambidexterity.

Furthermore, all the cases in our study are pursuing sustainability initiatives in a decentralized manner, with each area or division pursuing matters that are most relevant to them, with a group-level sustainability area that coordinates goals and reporting. Interestingly, the task of formulating and coordinating a CE strategy has been assigned to the sustainability functions, even though several respondents questioned whether a CE transformation could be pursued following the same approach as previous efforts toward sustainability. This was due to the synchronized, organization-wide deployment needed to achieve circular flows and the multiple radical changes required to optimize circular business models. While some studies have investigated networks and the orchestration of CE innovation in inter-firm networks (e.g., Hansen & Schmitt, 2021), we suggest further research is needed on coordinating CE efforts at the intra-firm level to highlight the role of key actors, structures, and the distribution and exercise of power inside different organizations.

5.5 | Limitations of the study

Our study is not without limitations. The data were collected from only three organizations. As this was an exploratory study with a case study design, we did not seek statistical generalizability of our findings. Instead, generalizability should be tested in future work using a greater number of cases. Furthermore, we conducted a limited number of interviews for each organization, which means our interviewees' individual perceptions greatly influence the data we collected. This was arguably partially mitigated by sharing our analysis with the interviewees as we developed it, and sharing the study results with the company representatives prior to this publication.

6 | CONCLUSIONS

Our study collects empirical data that we believe is important to develop the research on CE in society further, and specifically, research with an ambition to support the deployment of CE in industrial firms. In our study, we observed three large mature companies that are all strongly influenced by the demands of society and their

business environment. Furthermore, they have a relatively new insight regarding how critical it is to integrate sustainability with business. The cases have differences inherited from their core business, for example, manufacturing complex products compared with manufacturing advanced renewable materials, but all view CE as highly strategically important. They have clear CE agendas, and senior management has a strong commitment. However, as we have elaborated on in the discussion, CE is still not fully integrated. Furthermore, it is still unclear how CE is operationalized, relating to critical issues of how innovation within the firm is exploited and how new opportunities are explored. We found issues referring to (1) challenges and approaches to normative management, (2) how the innovation ecosystem is engaged, (3) how goals and metrics relate to CE, and (4) resources and coordination regarding the CE initiative. Our conclusions about these categories and suggested avenues for further research are presented below.

We find that deploying a circular strategy challenges several established norms in the organizations. Seemingly, the normative management issues that arise from the circular strategy deployment also relate strongly to achieving radical innovation (e.g., fostering experimentation, risk-taking, questioning business-as-usual). However, we do not see an active consideration of the latter in our cases. In contrast, many of the achievements so far have been driven by passionate individuals navigating outside of their usual roles and responsibilities, managing colliding interests between the linear business and their circular projects. Taking note of the experiences that these individuals have of “skunk work,” innovation championing, and managing exploration and exploitation is an exciting avenue for further research.

Large incumbents need to take an active role in building innovation ecosystems for closed resource loops, an ambition that should be reflected in their circular strategy. However, in our cases, we found generic support for the importance of close partnerships but missed a broader consideration of engaging the innovation ecosystem. Further research on this topic is suggested, specifically concerning how collaboration can be managed for both exploitation and exploration.

In order to give more specific direction from strategy, goals and metrics need to be considered as they are fundamental control mechanisms in organizations. Given the opposing views and different approaches found in our cases, managers need to tread with caution when using goals and metrics in relation to a circular strategy deployment to foster both radical and incremental innovation. Specifically, we see a need for further research to understand how goals for circular innovation can be mechanisms for driving organizational change, how they impact ideation, and their (in)compatibility with existing governance systems and measurements.

Our study shows that coordination between different parts of the organization enables circular innovation and the integration of a circular strategy. Specifically, we found that a lack of coordination could be more harmful for exploration than exploitation, thereby negatively impacting radical circular innovation. Therefore, coordination of resources is a critical issue when moving from a defined circular strategy to operation in the firm. Naturally, sufficient resources are always

relevant for achieving the set goals, but in the context of CE, it is also a matter of securing sufficient competencies. Relating to the coordination issues, we would also like to argue that individuals need to be enabled to pursue both exploration and exploitation in pursuing circular innovation, rather than structurally separating the different activities.

Finally, our cases show that when pursuing CE, firms identified the need for radical innovation not necessarily due to their CE strategy, but clearly to meet sustainability challenges. However, several of the efforts that we observed rely on exploitation. This observation reveals a possible risk that practitioners may take a wrong path if they attempt to transition to CE, by believing appropriate actions are being taken through exploitation and solely building on the solutions they have. At the same time, it is not feasible to focus on only radical innovation and explorative approaches when taking on challenges with the severity that CE entails, suggesting a balance that needs to be actively managed.

ACKNOWLEDGEMENTS

This research was funded by Vinnova [grant 2020-00713] and supported by EU Horizon 2020 [grant 776577-2]. We would like to thank the project partners and interviewees for their enthusiasm and time. We would also like to thank the anonymous reviewers for their constructive feedback and our colleagues at the Department of Integrated Product Development and Design for their valuable input, which improved this paper.

ORCID

Johan Arekrans  <https://orcid.org/0000-0001-6697-9811>

Sofia Ritzén  <https://orcid.org/0000-0002-4488-1028>

Rafael Laurenti  <https://orcid.org/0000-0002-7717-600X>

REFERENCES

- Adams, W. C. (2015). Conducting semi-structured interviews. In K. Newcomer, H. Hatry, & J. Wholey (Eds.), *Handbook of practical program evaluation* (Issue August 2015 (pp. 492–505)). John Wiley & Sons, Inc. <https://doi.org/10.1002/9781119171386.ch19>
- Aminoff, A., & Pihlajamaa, M. (2020). Business experimentation for a circular economy—Learning in the front end of innovation. *Journal of Cleaner Production*, 275(124051), 1–12. <https://doi.org/10.1016/j.jclepro.2020.124051>
- Araujo Galvão, G. D., De Nadae, J., Clemente, D. H., Chinen, G., & De Carvalho, M. M. (2018). Circular economy: Overview of barriers. *Procedia CIRP*, 73, 79–85. <https://doi.org/10.1016/j.procir.2018.04.011>
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120. <https://doi.org/10.1177/014920639101700108>
- Baumgartner, R. J. (2014). Managing corporate sustainability and CSR: A conceptual framework combining values, strategies and instruments contributing to sustainable development. *Corporate Social Responsibility and Environmental Management*, 21(5), 258–271. <https://doi.org/10.1002/csr.1336>
- Birkinshaw, J., Zimmermann, A., & Raisch, S. (2016). How do firms adapt to discontinuous change? Bridging the dynamic capabilities and ambidexterity perspectives. *California Management Review*, 58(4), 36–58. <https://doi.org/10.1525/cmr.2016.58.4.36>
- Bocken, N., & Ritala, P. (2021). Six ways to build circular business models. *Journal of Business Strategy*, 43, 184–192. <https://doi.org/10.1108/JBS-11-2020-0258>
- Brown, P., Von Daniels, C., Bocken, N. M. P., & Balkenende, A. R. (2021). A process model for collaboration in circular oriented innovation. *Journal of Cleaner Production*, 286, 125499. <https://doi.org/10.1016/j.jclepro.2020.125499>
- Brown, P., Bocken, N., & Balkenende, R. (2019). Why do companies pursue collaborative circular oriented innovation? *Sustainability (Switzerland)*, 11(3), 1–23. <https://doi.org/10.3390/su11030635>
- Cassell, C., & Symon, G. (2004). *Essential guide to qualitative research methods in organizational research*. SAGE Publications. 10.4135/9781446280119
- Christensen, C. M. (1997). The innovators dilemma: When new technologies cause great firms to fail. In *Business (Microsoft)*. Harvard Business School Press.
- Corvellec, H., Stowell, A. F., & Johansson, N. (2021). Critiques of the circular economy. *Journal of Industrial Ecology*, 26, 1–12. <https://doi.org/10.1111/jiec.13187>
- Creswell, J. W. (2014). Research design: Qualitative, quantitative, and mixed methods approaches. In *Sage research methods* (4th ed.). SAGE Publications, Inc.
- DeCuir-Gunby, J. T., Marshall, P. L., & McCulloch, A. W. (2011). Developing and using a codebook for the analysis of interview data: An example from a professional development research project. *Field Methods*, 23(2), 136–155. <https://doi.org/10.1177/1525822X10388468>
- Diaz Lopez, F. J., Bastein, T., & Tukker, A. (2019). Business model innovation for resource-efficiency, circularity and cleaner production: What 143 cases tell us. *Ecological Economics*, 155, 20–35. <https://doi.org/10.1016/j.ecolecon.2018.03.009>
- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532–550. <https://doi.org/10.5465/amr.1989.4308385>
- Emmel, N. (2013). Purposeful sampling. In *Sampling and choosing cases in qualitative research: A realist approach* (pp. 33–34). SAGE Publications Ltd. 10.4135/9781473913882
- Ethiraj, S. K., & Levinthal, D. (2009). Hoping for a to Z while rewarding only a: Complex organizations and multiple goals. *Organization Science*, 20(1), 4–21. <https://doi.org/10.1287/orsc.1080.0358>
- Ferasso, M., Beliaeva, T., Kraus, S., Clauss, T., & Ribeiro-Soriano, D. (2020). Circular economy business models: The state of research and avenues ahead. *Business Strategy and the Environment*, 29(8), 3006–3024. <https://doi.org/10.1002/bse.2554>
- Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, 12(2), 219–245. <https://doi.org/10.1177/1077800405284363>
- Frishammar, J., & Parida, V. (2019). Circular business model transformation: A roadmap for incumbent firms. *California Management Review*, 61(2), 5–29. <https://doi.org/10.1177/0008125618811926>
- Geissdoerfer, M., Pieroni, M. P. P., Pigosso, D. C. A., & Soufani, K. (2020). Circular business models: A review. *Journal of Cleaner Production*, 277, 123741. <https://doi.org/10.1016/j.jclepro.2020.123741>
- Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The circular economy—A new sustainability paradigm? *Journal of Cleaner Production*, 143, 757–768. <https://doi.org/10.1016/j.jclepro.2016.12.048>
- Gibson, C. B., & Birkinshaw, J. (2004). The antecedents, consequences, and mediating role of organizational ambidexterity. *The Academy of Management Journal*, 47(2), 209–226.
- Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. *Organizational Research Methods*, 16(1), 15–31. <https://doi.org/10.1177/1094428112452151>
- Grbich, C., Kitto, S. C., & Chesters, J. (2008). Quality in qualitative research: Criteria for authors and assessors in the submission and

- assessment of qualitative research articles for the Medical Journal of Australia. *Medical Journal of Australia*, 188(4), 243–246. <https://doi.org/10.5694/j.1326-5377.2008.tb01595.x>
- Hallstedt, S., Ny, H., Robért, K. H., & Broman, G. (2010). An approach to assessing sustainability integration in strategic decision systems for product development. *Journal of Cleaner Production*, 18(8), 703–712. <https://doi.org/10.1016/j.jclepro.2009.12.017>
- Hansen, E. G., & Schmitt, J. C. (2021). Orchestrating cradle-to-cradle innovation across the value chain: Overcoming barriers through innovation communities, collaboration mechanisms, and intermediation. *Journal of Industrial Ecology*, 25(3), 627–647. <https://doi.org/10.1111/jiec.13081>
- He, Z.-L., & Wong, P.-K. (2004). Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis. *Organization Science*, 15(4), 481–494. <https://doi.org/10.1287/orsc.1040.0078>
- Hofmann, F., & Jaeger-Erben, M. (2020). Organizational transition management of circular business model innovations. *Business Strategy and the Environment*, August, 29, 2770–2788. <https://doi.org/10.1002/bse.2542>
- Hopkinson, P., Zils, M., Hawkins, P., & Roper, S. (2018). Managing a complex global circular economy business model: Opportunities and challenges. *California Management Review*, 60(3), 71–94. <https://doi.org/10.1177/0008125618764692>
- Jansen, J. J. P., George, G., Van Den Bosch, F. A. J., & Volberda, H. W. (2008). Senior team attributes and organizational ambidexterity: The moderating role of transformational leadership. *Journal of Management Studies*, 45(5), 982–1007. <https://doi.org/10.1111/j.1467-6486.2008.00775.x>
- Jansen, J. J. P., Van Den Bosch, F. A. J., & Volberda, H. W. (2006). Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators. *Management Science*, 52(11), 1661–1674. <https://doi.org/10.1287/mnsc.1060.0576>
- Khan, O., Daddi, T., & Iraldo, F. (2020). Microfoundations of dynamic capabilities: Insights from circular economy business cases. *Business Strategy and the Environment*, 29(3), 1479–1493. <https://doi.org/10.1002/bse.2447>
- Kirchherr, J., Piscicelli, L., Bour, R., Kostense-Smit, E., Muller, J., Huibrechtse-Truijens, A., & Hekkert, M. (2018). Barriers to the circular economy: Evidence from the European Union (EU). *Ecological Economics*, 150(August), 264–272. <https://doi.org/10.1016/j.ecolecon.2018.04.028>
- Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, 127, 221–232. <https://doi.org/10.1016/j.resconrec.2017.09.005>
- Kirchherr, J., & van Santen, R. (2019). Research on the circular economy: A critique of the field. *Resources, Conservation and Recycling*, 151(August), 104480. <https://doi.org/10.1016/j.resconrec.2019.104480>
- Konietzko, J., Bocken, N., & Hultink, E. J. (2020). Circular ecosystem innovation: An initial set of principles. *Journal of Cleaner Production*, 253, 119942. <https://doi.org/10.1016/j.jclepro.2019.119942>
- Korhonen, J., Honkasalo, A., & Seppälä, J. (2018). Circular economy: The concept and its limitations. *Ecological Economics*, 143, 37–46. <https://doi.org/10.1016/j.ecolecon.2017.06.041>
- Lavie, D., Stettner, U., & Tushman, M. L. (2010). Exploration and exploitation within and across organizations. *Academy of Management Annals*, 4(1), 109–155. <https://doi.org/10.1080/19416521003691287>
- Leonard-Barton, D. (2011). Core capabilities and core rigidities: A paradox in managing new product development. *Managing Knowledge Assets, Creativity and Innovation*, 13, 13–27. https://doi.org/10.1142/9789814295505_0002
- Levinthal, D. A., & March, J. G. (1993). The myopia of learning. *Strategic Management Journal*, 14(S2), 95–112. <https://doi.org/10.1002/smj.4250141009>
- Lieder, M. (2017). From resource efficiency to resource conservation - studies, developments and manufacturing systems [Doctoral thesis, KTH Royal Institute of Technology, Stockholm, Sweden]. <http://urn.kb.se/resolve?urn=urn:nbn:se:kth:diva-212923>
- Lieder, M., & Rashid, A. (2016). Towards circular economy implementation: A comprehensive review in context of manufacturing industry. *Journal of Cleaner Production*, 115, 36–51. <https://doi.org/10.1016/j.jclepro.2015.12.042>
- March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science*, 2(1), 71–87. <https://doi.org/10.1287/orsc.2.1.71>
- McGrath, R. G. (2001). Exploratory learning, innovative capacity, and managerial oversight. *Academy of Management Journal*, 44(1), 118–131. <https://doi.org/10.2307/3069340>
- Moore, J. F. (1993). Predators and prey: A new ecology of competition. *Harvard Business Review, Reprint 93309*, 75–86. <https://hbr.org/1993/05/predators-and-prey-a-new-ecology-of-competition>
- Morse, J. M., Barrett, M., Mayan, M., Olson, K., & Spiers, J. (2002). Verification strategies for establishing reliability and validity in qualitative research. *International Journal of Qualitative Methods*, 1(2), 13–22. <https://doi.org/10.1177/160940690200100202>
- Nußholz, J. L. K. (2017). Circular business models: Defining a concept and framing an emerging research field. *Sustainability (Switzerland)*, 9(10), 14–17. <https://doi.org/10.3390/su9101810>
- O'Reilly, C. A., & Tushman, M. L. (2004). The ambidextrous organization. *Harvard Business Review*, 82(4), 74–82. <https://hbr.org/2004/04/the-ambidextrous-organization>
- Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research*, 42(5), 533–544. <https://doi.org/10.1007/s10488-013-0528-y>
- Pieroni, M. P. P., McAloone, T. C., & Pigosso, D. C. A. (2019). Business model innovation for circular economy and sustainability: A review of approaches. *Journal of Cleaner Production*, 215, 198–216. <https://doi.org/10.1016/j.jclepro.2019.01.036>
- Prieto-Sandoval, V., Jaca, C., Santos, J., Baumgartner, R. J., Ormazabal, M., Prieto-Sandoval, V., Jaca, C., Santos, J., Baumgartner, R. J., & Ormazabal, M. (2019). Key strategies, resources, and capabilities for implementing circular economy in industrial small and medium enterprises. *Corporate Social Responsibility and Environmental Management*, 26(6), 1473–1484. <https://doi.org/10.1002/csr.1761>
- Rashid, A., Asif, F. M. A., Krajnik, P., & Nicolescu, C. M. (2013). Resource conservative manufacturing: An essential change in business and technology paradigm for sustainable manufacturing. *Journal of Cleaner Production*, 57, 166–177. <https://doi.org/10.1016/j.jclepro.2013.06.012>
- Reike, D., Vermeulen, W. J. V., & Witjes, S. (2018). The circular economy: New or refurbished as CE 3.0?—Exploring controversies in the conceptualization of the circular economy through a history and resource value retention options. *Resources, Conservation and Recycling*, 135, 246–264. <https://doi.org/10.1016/j.resconrec.2017.08.027>
- Santa-Maria, T., Vermeulen, W. J. V., & 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*, 26, 872–891. <https://doi.org/10.1016/j.spc.2020.12.037>
- Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students* (5th ed.). Pearson Education Limited.
- Schaltegger, S., Hansen, E. G., & Lüdeke-Freund, F. (2016). Business models for sustainability: Origins, present research, and future avenues. *Organization and Environment*, 29(1), 3–10. <https://doi.org/10.1177/1086026615599806>
- Sehnm, S., Queiroz, A. A. F. S. L., Pereira, S. C. F., Santos Correia, G., & Kuzma, E. (2021). Circular economy and innovation: A look from the perspective of organizational capabilities. *Business Strategy and the Environment*, 2020, 1–15. <https://doi.org/10.1002/bse.2884>

- Sopjani, L., Arekrans, J., Laurenti, R., & Ritzén, S. (2020). Unlocking the linear lock-in: Mapping research on barriers to transition. *Sustainability*, 12(3), 1034. <https://doi.org/10.3390/su12031034>
- Stahel, W. (1982). The Product-Life Factor. In S. Grinton Orr (Ed.), *An inquiry into the nature of sustainable societies: The role of the private sector* (pp. 72–96). HARC-Houston Area Research Center.
- Technopolis Group, Fraunhofer ISI, Thinkstep, & Wuppertal Institute. (2016). Regulatory barriers for the Circular Economy: Lessons from ten case studies—European Commission (Issue July). http://ec.europa.eu/growth/content/regulatory-barriers-circular-economy-lessons-ten-case-studies-1_en
- Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, 20(1), 397–403. <https://doi.org/10.1002/smj>
- Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18, 509–533. [https://doi.org/10.1002/\(SICI\)1097-0266\(199708\)18:7<509::AID-SMJ882>3.0.CO;2-Z](https://doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z)
- Tsang, E. W. K., & Zahra, S. A. (2008). Organizational unlearning. *Human Relations*, 61(10), 1435–1462. <https://doi.org/10.1177/0018726708095710>
- Tura, N., Hanski, J., Ahola, T., Stähle, M., Piiparinen, S., & Valkokari, P. (2019). Unlocking circular business: A framework of barriers and drivers. *Journal of Cleaner Production*, 212, 90–98. <https://doi.org/10.1016/j.jclepro.2018.11.202>
- Tushman, M. L., & O'Reilly, C. A. (1996). Ambidextrous organizations. *Managing Evolutionary and Revolutionary Change. California Management Review*, 38(4), 8–29. <https://doi.org/10.2307/41165852>
- Visscher, K., Hahn, K., & Konrad, K. (2020). Innovation ecosystem strategies of industrial firms: A multilayered approach to alignment and strategic positioning. *Journal of Creativity and Innovation Management*, 30, 619–631. <https://doi.org/10.1111/caim.12429>
- Wheelwright, S. C., & Clark, K. B. (1992). *Revolutionizing product development: Quantum leaps in speed, efficiency and quality*. Simon and Schuster.
- Yin, R. K. (2002). Case study research and applications: Design and methods. In *Applied social research methods series* (2nd ed.) (pp. S16–S26). SAGE Publications. <https://doi.org/10.1016/j.jada.2010.09.005>

How to cite this article: Arekrans, J., Ritzén, S., & Laurenti, R. (2022). The role of radical innovation in circular strategy deployment. *Business Strategy and the Environment*, 1–21. <https://doi.org/10.1002/bse.3108>

APPENDIX A: INTERVIEW GUIDELINE

[Project introduction and ask for permission to record.]

[Ask for general respondent information, position, years at company]

A. Circular economy

1. What is circular economy for you currently?
 - a. Is it long-term or short-term?
 - i. What time-perspectives are you working with? Is there an urgency to change? (regulation? market demand?)
 - b. Is it strategic, in what way?
 - i. Do you think that CE is well integrated in your overall strategy (or that it should be)? Or, is it treated as a separate issue (and should it be)?
 - ii. What resources are (or were) deployed to strategize and accelerate toward CE?
 - iii. Would you say that a shift toward CE has been a top-down initiative or bottom-up, and how so?
2. How did your initial shift toward CE look like?
 - a. Have you experimented with your business model in relation to CE?
 - b. What did you learn from that experience, as an organization?
3. What are the challenges/barriers to CE you have encountered or foresee?

- a. Of which nature are they? Severity? Technological/material, product design, business model, incentives, supply chain, internal culture, customer behavior, regulations, ...
 - b. Which can be handled by your organization and which require help from the outside?
 - c. What do you see as key changes that must occur within your organization in order for you to become a more mature in becoming circular?
4. What are the direct and indirect impacts or effects that you have seen already within the organization from your work with CE?
- ### B. Radical and disruptive innovation
1. Do you believe transition to CE requires radical and disruptive changes for your organization, or, is it less fundamental for you? In what way?
 2. How well organized would you say that your organization is to manage radical and disruptive innovation? Examples of why/why not?
 3. How well accepted are new and risky projects that do not fit the current business model? What criteria are they evaluated on? How do you see CE initiatives fitting in?
- ### C. Ecosystem and partnerships
1. What role does your company have in your value networks? Recent changes or new roles in this in relation to your work with CE?

2. What does your business network/value chain look like? How does the collaboration look like? Changes in relation to CE? New partnerships?
 3. Is co-creation of value relevant? How are users addressed? Are users involved?
- D. Business model innovation
1. Do you work actively on innovating your business model? On what grounds/why not? In what way?
 2. Do you have a process or a model which you follow when you are considering your business model? Do you consider sustainability questions somehow?
 3. Who is involved in innovating the business model?
- E. Sustainability and strategy
1. In what way is sustainability critical to you, is it a strategic issue?—In what way have you worked with it as a strategic issue?
 2. What would you say is the driver for sustainability as a strategic issue? Brand image? Business value?
 3. If you compare your sustainability goals with other goals of the organization, are they similar in how they are governed?
 4. What are the major events, projects or changes that you think have been important to how you view or manage sustainability within the company today?
- F. General company information (Complementary questions 1–2 respondents/company)
1. What would you say is the company vision currently? How are you planning to reach that vision? Are there any strategies/means in place for reaching long term goals?
 2. How are you organized today? How do you work with governance: processes, control mechanisms?
 3. How does your core business model look like? Is it affected by any recent changes company vision or strategy?
 4. Who is your largest competitor? Is there competition that is not typical/traditional? Competition with a different business model, offering or product?
Five to 10 years from now, what do you think will be the major differences in terms of your offerings and ways of working?
- G. Closing
1. Is there anything you would like to add on this topic?
 2. Other interviewees that might be of interest to us?
 3. Can we contact you again if we have any follow-up questions?

APPENDIX B: CODEBOOK

This contains the codebook that was being used for the initial coding of the transcribed data. The column “Files” refers to number of interviews, whereas “Used” refers to the number of total usages of the code.

Code	Description	Files	Used
BUSINESS MODEL	When the business model is mentioned, affected, changed, new requirements, and new setup	21	93
CE BARRIER	What are the challenges, problems, hurdles to overcome in CE? Future, past, and present	28	186
CE CHAR	Characteristics. How do they describe what is characteristic for their CE journey? What is characteristic for their industry? Organization? Maturity?	28	142
CE DRIVER	What drives the CE initiative? Why are they doing it? What is the rationale or motivation behind it?	27	117
CE ENABLER	What is enabling CE? How are barriers being overcome? Once there is a drive/initiative present, what is making it possible?	25	110
CE EXAMPLE	Used whenever a respondent gives an example of a circular pilot, project, or business that they are running or planned	17	40
CE IMPACT	What impact has CE had on the company so far? Current activities/efforts in CE? What has been done?	22	72

Code	Description	Files	Used
COMPANY INFORMATION	Describing the company and its setup, structure	17	33
DIVISION SPECIFIC	Describing how their particular division works rather than the entire company	9	23
GOALS & MEASUREMENTS	Specific goals and measurements (or lack of/need for)	26	105
INDUSTRY SPECIFIC	Describing something that is unique or special for the specific industry of the business that the company is in	18	45
INNOVATION MANAGEMENT	Innovation management. Is innovation managed? Strategic? Portfolio management ...	20	60
INTEGRATION	Integration of different function/roles/departments, NOT specifically CE/sustainability	15	53
MARKET	Customers, customer demand, and market specifics	24	75
MEASURES & ACTIONS	When respondents describe actions or measures required/taken (to move toward CE)	28	111
NETWORK	Describing collaboration (or lack thereof), innovation ecosystem, partnerships, stakeholders, and supply chain	23	129
PEOPLE, RESPONDENT INFO	Describing what the respondent does, history, general information, and coworkers	26	49
PSS	Changes to products and/or the product-service systems.	19	59
RADICAL	Relating to radical innovation (specific question asked)	20	50
ROLES & RESPONSIBILITIES	Describing roles and responsibilities, current or missing (e.g., no CE director)	11	27
STARTING POINT	How the CE journey started, setting and conditions. A point in time which was crucial for how CE has unfolded in the company.	25	82
STRATEGY	Business strategy, sustainability strategy, CE and strategy, and other strategic initiatives	28	188
STUDY REACTION	Used to gather comments and reactions to CET study focus	17	27
SUPPLY CHAIN	Description of the supply chain and how it is managed, actors within the supply chain, and relationships with these	9	21
SUSTAINABILITY INTEGRATION	How sustainability is (or is not) integrated and considered in other company activities	24	92
VALUE PROPOSITION	Describing what the main offering looks like	12	27