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Drivers and barriers for circular business model innovation

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[Correction added on 06 January 2023, after first online publication: The e-mail address of Martin Geissdoerfer has been updated in this version.]

Abstract

The circular economy concept is gaining traction in academia, industry and policy-making as a strategy to reduce resource depletion, waste and emissions. Many authors see business model innovation as a critical lever for the concept's implementation on the organisational level. Despite the importance of the topic, the drivers and barriers to different types of circular business model innovation remain unclear. We address this gap by comparing drivers and barriers for four generic circular business model innovation types: start-up, diversification, transformation and acquisition. Relying on a structured comparative literature review using cross-reference searches, we develop a theoretical framework of drivers and barriers that we apply to a multi-case study of 21 organisations covering three of the four types, with some additional insights on the fourth. We identify 25 barriers and 10 drivers, clustered into seven categories, and outline how they distinctively affect the innovation types. Start-ups and diversifications are more commonly driven by market and financial factors, while transformations are led by market and organisational factors. These three types are highly affected by legal and financial barriers; however, while start-ups are more prone to face value chain challenges, incumbents are more susceptible to market and organisational barriers. Our study provides novel empirical data that validate and complement previous research and offers an additional analysis perspective in the transition towards a more sustainable and circular economy.

KEYWORDS
circular business model innovation, circular economy, drivers and barriers, multiple case study, sustainable business model

Abbreviations: BM, business models; CBMI, circular business model innovation; CBM, circular business models; CE, circular economy.

1 | INTRODUCTION

In recent years, the circular economy (CE) has gained traction as a strategy to reduce resource extraction, waste and emissions. The concept is increasingly supported as a central element in the transition to a more sustainable economic system by academia, policymaking and prominent business figures (Bradford, 2020; Economist, 2020; EPA Network, 2020; OECD, 2020; Schroeder et al., 2019). Implementing business models (BMs) aligned with the CE principles is crucial for the transition. However, to rate of adoption of these CBMs in the market has been low (Bocken et al., 2017; OECD, 2019). Circular business model innovation (CBMI) is a complex organizational challenge that faces multidimensional barriers and is supported by distinct (Guldmann & Huulgaard, 2019; Tura et al., 2019). The underlying notion of CBMI is increasingly understood (see, e.g., Geissdoerfer et al., 2020; Lüdeke-Freund et al., 2019; Pieroni et al., 2019; Santa-Maria et al., 2021a), and advances have been made in investigating its drivers and barriers (Tura et al., 2019; Vermunt et al., 2019). However, there is a need for more evidence-based research into these drivers and barriers and, given the practical and theoretical importance of the topic, to explore them from actionable managerial perspectives to support firms in the CBMI process. According to Geissdoerfer et al. (2020), the CBMI process can take four forms: firms can innovate as (1) circular start-ups, (2) diversifying or (3) transforming their BM towards the CE or (4) acquiring external CBMs. Despite the practical and theoretical importance of how drivers and barriers affect the four different types of CBMI, this remains unexplored in the literature.

This article aims to address the described research gaps by empirically addressing the following research question: *What are the drivers and barriers for the different types of circular business model innovation?*

This exploratory study addresses this question through a comparative multiple case study approach on 21 firms that have successfully implemented a CBM in the market.

This paper is structured as follows: After this introduction, Section 2 provides a short literature review introducing the underlying concepts of the research. Section 3 illustrates the employed method of the research, before Section 4 presents the resulting findings. This is followed by a discussion of the findings in Section 5, before the paper concludes with some final remarks in Section 6.

2 | CONCEPTUAL BACKGROUND

This section introduces the two underlying concepts of this research: CBMI (Section 2.1) and drivers and barriers for CBMI (Section 2.2).

2.1 | CBMI

The CE minimises resource input and waste, emission and energy leakages by cycling, extending, intensifying and dematerialising material and energy loops through digitalisation, servitisation, sharing solutions, long-lasting product design, maintenance, repair, reuse, remanufacturing, refurbishing and recycling (Geissdoerfer et al., 2017, 2020). After initially focusing on technological aspects, like recycling methods, CE research has pivoted to BM to gain an effective unit of analysis to investigate drivers and barriers to the adoption of existing circular technologies (Rashid et al., 2013).

The concept of circular business models (CBMs) emerged considerably more recently than the overarching CE notion. The term first appeared in 2006 in an article by Schwager and Moser (2006) that explored individual BM types for circular value creation and only re-emerged 7 years later, coinciding with the broader dissemination of the CE notion by the Ellen MacArthur Foundation and the World Economic Forum (EMF, 2012; WEF, 2014). Since 2015, publications have grown exponentially, and there is already a range of reviews that provide a good overview of the topic (e.g., Bocken et al., 2018; Bocken, Strupeit, et al., 2019; Diaz Lopez et al., 2019; Geissdoerfer et al., 2020; Pieroni et al., 2019).

Most definitions of the CBM concept (e.g., Den Hollander & Bakker, 2016; Galvão et al., 2020; Nußholz, 2017) are based on the value creation logic of Richardson (2008), that is, a three-element framework of value proposition, value creation and delivery, and value capture or the—probably derived—BM definition of Osterwalder and Pigneur (2010), that is, 'the rationale of how an organisation creates, delivers, and captures value' (p. 14) (Geissdoerfer et al., 2020). This is then combined with CE principles (Lüdeke-Freund et al., 2019; Manninen et al., 2018; Zucchella & Previtali, 2019) or CBM strategies (Bocken, Boons, & Baldassarre, 2019; Geissdoerfer, Morioka, et al., 2018; Geissdoerfer et al., 2020; Oghazi & Mostaghel, 2018).

Following the latter school of thought, in this research, CBMs are understood as 'simplified representations of the value proposition, value creation and delivery, and value capture elements and the interactions between these elements within an organisational unit' (Geissdoerfer, Vladimirova, & Evans, 2018, p. 402), that [is] cycling, extending, intensifying and/or dematerialising material and energy loops to reduce the resource inputs into and the waste and emission leakage out of an organisational system. This comprises recycling measures (cycling), use phase extensions (extending), a more intense use phase (intensifying) and the substitution of products by service and software solutions (dematerialising) (Geissdoerfer et al., 2020, p. 7). These four core strategies—cycling, extending, intensifying and dematerialising—can be combined in different configurations within one BM—for example, implementing a variety of 'R' value retention options—and can be complemented by two supporting strategies—increasing efficiency (Bocken et al., 2016) and utilising renewable resources (Webster, 2015).

To arrive at a CBM, organisations undergo a CBMI—or BM innovation for the CE—process. There is a considerably smaller range of definitions for this concept, which can also be rather simplistic. However, based on the relatedness of the BM innovation concept to the BM concept, Geissdoerfer et al. (2020) have recently provided a helpful definition for our research: 'circular business model innovation can be defined as the conceptualisation and implementation of circular business models'(p. 7) and have also provided a framework of four different types of CBMI identified in the literature: (1) circular start-ups, (2) CBM diversification, (3) CBM transformation and (4) CBM acquisition, illustrated in Figure 1.

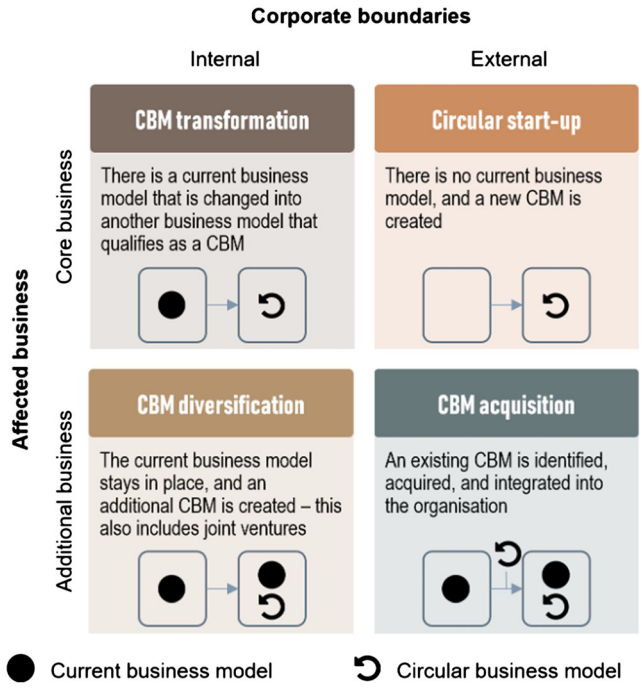

FIGURE 1 Four types of circular business model innovation (Geissdoerfer et al., 2020)

2.2 | Drivers and barriers for CBMI

We understand drivers and barriers for CBMI as factors that either support or inhibit an organisational unit's conceptualisation and implementation of CBMs (Geissdoerfer, 2019; Santa-Maria et al., 2021a; Tura et al., 2019).

The theme of drivers and barriers for companies to design, develop and implement CBMs has been widely researched, with more than 30 publications dealing with this topic to some extent since 2014, 11 of which have put a central focus on barriers and five on both drivers and barriers (Santa-Maria et al., 2021a).

Mentink (2014) offered a broad review of the literature on drivers and barriers to support the proposition of a CBMI process model; Rizos et al. (2016) focused on barriers for SMEs; Govindan and Hasanagic (2018) offered a systematic review of drivers and barriers from a supply chain perspective and Bressanelli et al. (2019) went one step further identifying barriers by lifecycle phase and supply chain actor. Diaz Lopez et al. (2019) offered the first large case ($n = 143$) analysis of barriers for implementation; Brown et al. (2019) focused on drivers and barriers to pursuing collaborative circular-oriented innovation; Vermunt et al. (2019) explored barriers per type of CBM (i.e., product-as-a-service, product life extension, resource recovery and circular supplies) and Tura et al. (2019) offered a systematic categorization of drivers and barriers into seven-factor categories (i.e., environmental, economic, social, political and institutional, technological and informational, supply chain and organisational). Russell et al. (2020) researched drivers and barriers for bottom-up CE initiatives by implementation stage. Guldmann and Huulgaard (2020), differentiating by company size, identified novel barriers for CBMI from the study of 12 cases. More recently, a few articles have searched for not only drivers and barriers but also on enablers and means of overcoming the barriers, such as von Kolpinski et al. (2022), who studied 12 circular start-ups, Barford and Ahmad (2022) on an in-depth study of a large incumbent and Galvão et al. (2022) who studied 40 firms. However, research on drivers and barriers to CE implementation is still prominently theoretical or based on a small number of cases. Thus, several authors have called for further empirical studies on the identified factors (Guldmann & Huulgaard, 2020; Henry et al., 2020).

Furthermore, and of particular interest to this research is that extant research has explored how start-ups and incumbents play distinctive roles in the sustainability transition of a market (Hockerts & Wüstenhagen, 2010) and provide insights into how they are supported and inhibited by a different set of drivers and barriers, particularly depending on chosen market entry strategies, be it through acquisitions, alliances, diversification or entrepreneurship (Cohen & Muñoz, 2017; Rovanto & Bask, 2020). As accounted for in the previous paragraph, the identification and classification of drivers and barriers have been done from varied perspectives. However, none of the articles has attempted to differentiate factors between the four CBMI types (Geissdoerfer et al., 2020), a relevant perspective to better understand the sustainability transition of the markets. The present article adds to the body of knowledge by providing novel empirical data on the drivers and barriers for CBMI and by contrasting the identified factors between the different types of CBMI.

3 | METHOD

To explore the drivers and barriers for CBMI, this study has performed a multiple case study (Eisenhardt, 1989; Yin, 2013), identifying, describing and contrasting drivers and barriers of firms representing three of the four types of CBMI (i.e., start-ups, transformation and diversification) (Geissdoerfer et al., 2020). Case studies enable an in-depth collection of data, and a multiple case approach allows to contrast and complement individual insights, facilitating the generation of hypotheses in context-dependent phenomena (Yin, 2013), thus offering a suitable approach for under-explored topics like the one investigated in this research.

Cases were selected by applying a purposive theoretical sampling approach, which enables efforts to be focused on theoretically valuable situations, selecting those that duplicate or advance theory by filling conceptual categories (Eisenhardt, 1989). Cases were required to be firms that have successfully introduced to the market a project representing any of the four CBMI types, thus offering the possibility to do a retrospective study of drivers and barriers. We intended to focus on cases with disruptive potential. Therefore, conceptual or early-stage innovations were not considered in case selection. Replicating the selection logic of Florén et al.'s (2018) CBMI study, the innovation was required to be substantial, thus affecting at least two of the three value dimensions of a BM (i.e., value proposition, value creation and delivery and value capture [Richardson, 2008]). To improve the external validity of findings and to avoid biases, variation within the sample was sought (Bryman, 2012). We selected cases representing a mix of CBM strategies (Bocken et al., 2016; Geissdoerfer, Morioka, et al., 2018; Geissdoerfer

et al., 2020), implementing various R-value retention options and representing a mix of industries, company sizes and countries.

Potential cases fulfilling the criteria were identified and contacted based on desk research and recommendations from the authors' network. Our unit of analysis is the firm; however, we included in our sample three firms that offered two CBMI examples. The final sample consisted of 21 organisations undergoing CBMI: three CBM transformations, nine CBM diversifications and four circular start-ups (see Table 1 for case descriptions). Various CBM acquisition cases were identified and contacted to participate in the study. The sample contained nine large, three medium and nine small companies. The selection included firms from five European countries and 15 industries, of which seven were B2C and 14 B2B. The sample effectively represented a varied mix of CBM strategies and R-value retention options, as seen in Table 1.

Data were collected between May 2019 and June 2021 through recording expert interviews with experts in the circular business that had in-depth knowledge of the innovation case and its process (e.g., CEO, sustainability manager, innovation manager and product developer). According to Gläser and Laudel, experts are, among other things, witnesses to facts. The facts are reconstructed from the statements of these witnesses (Gläser & Laudel, 2009, p. 12). The focus of this study is to investigate the facts of drivers and barriers for CBMI types. Therefore, managers and CEOs of circular companies are considered experts in this context. Interviews were done in person during the first months of the research, though they were done remotely in the second half of the study due to the COVID-19 pandemic circumstances. Data from interviews were complemented and triangulated (Yin, 2013) with on-site visits to facilities, publicly available information (e.g., company reports and corporate websites) and researcher field notes, whenever these possibilities were feasible due to health restrictions. The interview protocol was designed to be flexible, including several open-ended questions, thus allowing respondents to naturally focus on distinctive case aspects that could provide valuable insights to this explorative qualitative research. After asking general questions about the firm, the role of respondents in the innovation process and a description of the BM innovation case, the interviewer asked open-ended questions on both drivers and barriers faced before and during the innovation process. The interview protocol included questions on other aspects of the innovation and its change processes, such as antecedents, moderators, organisational effects and data that have been used in complementary studies where the authors have recently participated (e.g., Henry et al., 2020; Santa-Maria et al., 2021b).

Data were analysed guided by a grounded theory approach (Corbin & Strauss, 2007; Gioia et al., 2013; Walker & Myrick, 2006). In the first step, interview records were verbatim transcribed and supported by the MAXQDA software; all the qualitative data sets were inductively coded. Using an open coding approach (Corbin & Strauss, 2007), we aimed to identify emerging types of drivers and barriers. Even though researchers were familiarised with drivers and barriers from the literature, we purposefully decided to do an initial open coding without predefined categories or known names of barriers and drivers, to avoid confirmation biases (Gioia et al., 2013), attempting to find surprising insights. It is worth mentioning that because we made open-ended questions on drivers and barriers, it is possible that some factors not identified in our analysis were however present in a given case. After the initial open coding, an axial coding exercise was done (Corbin & Strauss, 2007), combining closely related codes and reducing the total number of identified factors. Finally, a theoretical coding exercise (Walker & Myrick, 2006) allowed us to deductively cluster drivers and barriers into categories, guided by previous descriptions and categorizations from the literature, most relevantly adapting the categorisation of the comprehensive review of Tura et al. (2019).

4 | RESULTS

To explore the drivers and barriers for CBMI, we undertook a multiple case study analysis on 21 companies representing CBM transformations, CBM diversifications and circular start-ups (Geissdoerfer et al., 2020). After analysing the case data, we identified 10 distinctive drivers and 25 barriers, which we clustered into seven categories: financial, legal, market, technical, value chain and organisational. Tables 2 and 3 summarise the results of the data analysis process, characterising each driver and barrier identified, providing a short description and indicating the identified presence throughout cases. Exemplary quotes of each driver and barrier can be found in Appendix A.

This section presents which factors seem relevant to the CBMI phenomenon. We applied a purposive sampling strategy accounting for 21 cases, thus not necessarily being a representative sample from which generalisable conclusions could be immediately drawn. Within the boundaries of an exploratory study, here we provide the results of a relevance assessment based on the prevalence of factors throughout our studied cases. The statements here provided should be considered propositions to be tested in further quantitative studies.

4.1 | Drivers

Financial drivers were identified as the most relevant driver category in our study (23 identifications), where the most common specific drivers mentioned were 'business growth' (12 cases) and 'cost reduction' (eight cases). The second most relevant category was market drivers (20 identifications), where 'changing customers' demands' (14 cases) was the most repeated driver. Of high relevance were also the technical driver of 'new technological opportunity' (seven cases) and the organizational driver of 'corporate sustainability' (eight cases). Of interest is also that legal drivers were the less common in our sample.

4.2 | Barriers

The category that seems to be more relevant is market barriers (25 identifications) where the specific barriers more prevalent were 'lack of customer demand' (six cases), 'lack of social awareness' (five cases) and 'lack of standardisation' (five cases). The second and third most relevant categories were value chain and financial factors

TABLE 1 Case descriptions

Firm ID	CBMI type (Geissdoerfer et al., 2020)	Industry	B2B or B2C	Country[1]	Size	Position(s) interviewed	CBMI case(s) brief description	CBM strategy (Geissdoerfer, Vladimirova, & Evans, 2018)	Value proposition	Value creation and delivery	Value capture	R-value retention options
T1	Transformation	Carpets	B2B	NL	Large	Head of sustainable development	A 25-year journey to become carbon neutral, developing recyclable products with 100% recycled content, with a take-back scheme, focusing on servicing (maintenance & repair)	Cycling, extending	Carbon-neutral, durable modular carpets	Production, maintenance, and recovery of carpet tiles	Sell carpet tiles with a 15-year warranty	R1:Reduce, R2: Reuse, R3: Repair, R7: Recycle
T2	Transformation	Carpets	B2B	NL	Large	Director sustainability	Journey to transform linear and carbon-intensive production into a 90% cradle-to-cradle certified offer	Cycling	Cradle-to-cradle certified flooring solutions(e.g., carpets)	Production, maintenance, and recovery of products	Product sell contract	R0:Refuse, R1: Reduce, R2: Reuse, R7: Recycle
T3	Transformation	Retail packaging	B2B	UK	Small	CEO, head of marketing	Creation of a circular value chain for plastic food containers in partnership with suppliers and customers	Cycling	Plastic containers for food	Forming containers from plastic foil and delivering them to food producers	Conventional product for money contracting	R7:Recycle
D1	Diversification	Recycling & Waste Management	B2B	AT	Large	Managing director (of corporate spin-off)	Creating an app-based waste disposal platform, connecting construction companies with waste disposal firms, optimising logistics and idle capacity	Intensifying, cycling	Hassle-free construction waste management	App connects to waste disposal firms in a logistically efficient manner	Commission percentage of the price of the waste removal service	R1:Reduce, R7: Recycle

(Continues)

TABLE 1 (Continued)

Firm ID	CBMI type (Geissdoerfer et al., 2020)	Industry	B2B or B2C	Country[1]	Size	Position(s) interviewed	CBMI case(s) brief description	CBM strategy (Geissdoerfer, Vladimirova, & Evans, 2018)	Value proposition	Value creation and delivery	Value capture	R-value retention options
D2	Diversification	Furniture & Home accessories	B2C	AT	Large	Country sustainability manager	Implementation of a take-back, re-furbish, and re-sell service for furniture and appliances	Extending	Give old furniture a second life	Clients return furniture; it is refurbished and resold	Sell reused/ refurbished furniture at discounted price	R2:Reuse, R3: Repair, R4: Refurbish
D3	Diversification	Fibres and textiles	B2B	AT	Large	Senior manager sustainability integration, head of product management	Introduction of textile fibre that incorporates renewable biomaterials and recycled cotton scraps	Cycling	Circular and bio-sourced textile fibres	Scrap recovery, mixed with biomaterials to produce textile	Sell of textile	R7:Recycle, R1: Reduce
D4	Diversification	Flexible packaging	B2B	AT	Large	VP group sustainability	Introduction of a fully recyclable flexible packaging product line	Cycling	Certified recyclable flexible packaging	Production in the plant is 100% dedicated to recyclable solutions	Sell of packaging	R7:Recycle
D5	Diversification	Industrial machinery	B2B	AT	Medium	Head of product management	Introduction of a machine-as-a-service rental scheme, where the firm retains ownership and charges based on daily fee and hour use	Dematerialising, intensifying, extending	Rent of industrial machinery	Production, maintenance and repair of machinery	Fee-based on days or hours of use	R2:Reuse, R3: Repair
							Introduction of a certified used machine line. The business model includes active take-back, repair, refurbishment, and resell.	Extending	Buy a certified used industrial machinery	Active take-back structured refurbishing process and resell	Sell refurbished machinery at discounted price	R3:Repair, R4: Refurbish, R1: Reduce

TABLE 1 (Continued)

Firm ID	CBMI type (Geissdoerfer et al., 2020)	Industry	B2B or B2C	Country[1]	Size	Position(s) interviewed	CBMI case(s) brief description	CBM strategy (Geissdoerfer, Vladimirova, & Evans, 2018)	Value proposition	Value creation and delivery	Value capture	R-value retention options
D6	Diversification	Medical electronics	B2B	NL	Large	Senior director sustainability, business partner for sustainability and circular economy strategy	Development of a life-extending program for complex medical electronics, financially assisted. Incorporates upgrading, repairing, taking back, refurbishment and reselling	Extending	Medical electronics upgrading and life-extending program	Upgrading of technology, maintenance, and take-back coordination	Leasing/ financing contracts	R3:Repair, R4: Refurbish, R5: Remanufacture
							Introduction of a system solution for monitoring based on product-as-a-service contracts. The producer retains ownership, and the client is charged based on consumption. Training, upgrading and access to the latest technology included	Dematerialising, extending	Access to monitoring services, including upgrading and training	Production, provision, and management of equipment	Per-patient fee model	R2:Reuse, R3: Repair

(Continues)

TABLE 1 (Continued)

Firm ID	CBMI type (Geissdoerfer et al., 2020)	Industry	B2B or B2C	Country[1]	Size	Position(s) interviewed	CBMI case(s) brief description	CBM strategy (Geissdoerfer, Vladimirova, & Evans, 2018)	Value proposition	Value creation and delivery	Value capture	R-value retention options
D7	Diversification	Hygienic paper	B2B	NL	Small	Innovation & Business Intelligence Manager	Introduction of a locally closed-loop model to recycle a firm's waste to source another product to the same firm. Cradle-to-cradle certified.	Cycling	Closed-loop cradle-to-cradle certified hygienic paper	Coordinate the ecosystem to source, produce and provide the product	Service and supply contracts	R7:Recycle, R1: Reduce; R0: Refuse
D8	Diversification	Logistic process automation	B2B	NL	Large	Director Strategy & Sustainability, sustainability intern, Specialist R&D Engineer, R&D engineer	Introduction of an energy-efficient re-designed logistic solution with high recycled content, recyclable, feasible to be remanufactured and cradle-to-cradle certified	Cycling, extending	Cradle-to-cradle certified conveyor belt	Production and servicing of the product	Sell of logistic solution	R3:Repair, R4: Refurbish, R5: Remanufacture, R7:Recycle
							Introduction of a radical technological innovation offered through 4 alternative product-as-a-service contracts. Individual machines can be reused in different applications, are designed for easy maintenance, repair, refurbishment, and recycling.	Extending, intensifying, dematerializing, cycling	Access to autonomous transporters that reduce 50% of energy costs	Production, maintenance, refurbishment, and recycling of product	4 alternative product-as-a-service contracts	R2: Reuse, R3: Repair, R4: Refurbish, R5: Remanufacture, R7:Recycle

TABLE 1 (Continued)

Firm ID	CBMI type (Geissdoerfer et al., 2020)	Industry	B2B or B2C	Country[1]	Size	Position(s) interviewed	CBMI case(s) brief description	CBM strategy (Geissdoerfer, Vladimirova, & Evans, 2018)	Value proposition	Value creation and delivery	Value capture	R-value retention options
D9	Diversification	Oil and gas	B2B	ES	Large	Venture team lead plus 2 team members	Development of spin-off to reuse waste energy of transformation processes to sell to energy-intensive businesses in the vicinity	Cycling	Cheap local energy supply	Capturing and transmitting waste energy from processes	Pay per kWh	R2:Reuse
S1	Start-up	Electronics	B2C	DE	Medium	Co-founder	A marketplace for refurbished products, which connects professional refurbishers with customers	Cycling	Refurbed electronics at a discounted price with guarantee and sustainability promise (1 tree per purchase, reuse of products)	Refurbishment of outdated, obsolete or defective electronics, can be purchased online	Sale of refurbed electronics	R2:Reuse, R3: Repair, R4: Refurbished
S2	Start-up	Textile	B2C	DE	Small	Co-founder	A circular fashion start-up that designs and experiments with recycled materials towards product development, a marketplace for deadstock material	Extending, cycling	Sustainable fashion from recycled or deadstock materials	A platform for sustainable textile residues, experimenting with new circular raw materials; goal: Innovation for textile recycling	Sale of textile products and consulting	R7:Recycle
S3	Start-up	Mobility	B2C	DE	Medium	Regional manager	A platform that offers shared electric vehicles as a new, flexible way of mobility	Intensifying	'Sharing vehicles across large regions and repairing them when defect'	You can find and use the nearest vehicles via an app.	Pay per minute	R1:Reduce

(Continues)

TABLE 1 (Continued)

Firm ID	CBMI type (Geissdoerfer et al., 2020)	Industry	B2B or B2C	Country[1]	Size	Position(s) interviewed	CBMI case(s) brief description	CBM strategy (Geissdoerfer, Vladimirova, & Evans, 2018)	Value proposition	Value creation and delivery	Value capture	R-value retention options
S4	Start-up	Furniture	B2B	DE	Small	General manager	Creation of a circular model for used goods through standardization and extreme networking of all those involved	Extending	Certification model for furniture so that it can be passed on and used without liability	Taking over unwanted furniture, e.g., from companies, and passing it on	Not established yet, probably by selling the certified furniture	R1: Reduce, R2: Reuse
S5	Start-up	Furniture	B2B	NL	Small	Co-founder	A company that advising businesses to become frontrunners in sustainable plastics	Cycling	Deep knowledge on circular plastics	Business advice/ consulting	Business advisory service	R1: Reduce, R2: Reuse, R7: Recycle
S6	Start-up	Materials	B2B/ B2C	NL	Small	Founder	Start-ups that is producing circular, 100% bio exports pallets made from coconut husk waste	Cycling	100% bio pallets from coconut husk	Production and sale of pallets	Conventional product for money contracting	R7: Recycle
S7	Start-up	Materials	B2C	NL	Small	Co-founder	Company on sustainable sportswear, made from industrial hemp, eucalyptus, organic cotton, etc.	Cycling	Bio-based sustainable sportswear	Sourcing and distribution of sustainable sportswear	Conventional product for money contracting; subscription model	R7: Recycle
S8	Start-up	Floors	B2B/ B2C	DE	Small	CEO	Start-ups that creates circular flooring, mostly from recycled paper products	Cycling	Flooring from recycled paper	Product and sale of recycled flooring	Conventional product for money contracting	R7: Recycle
S9	Start-up	3D printing/ textiles	B2C	NL	Small	Co-founder	Company that offers 3D printed knitwear that is locally produced	Cycling		Production and sale of knitwear	Conventional product for money contracting	R1: Reduce

[1]ISO 3166 code.

TABLE 2 Description of drivers for circular business model innovation

Category	Driver name	Short description	CBM start-up	CBM transformation	CBM diversification
Financial	Business growth	Potential for new business development and access to new markets	S1, S2, S3, S5, S6, S7, S8, S9		D1, D2, D5, D6, D9
	Business resilience	Reduction in exposure from external shocks such as price fluctuations or supply chain disruptions		T1	D7
	Cost reduction	Potential for efficiency in costs	S1, S2, S3, S4		D2, D5, D6, D7
	Resource scarcity	Prevent future raw material scarcity			D2
Legal	Regulatory push	Regulations promoting the development of a circular economy	S2		D5
	Legal compliance	Compliance with recent (and future) legal regulations and standards	S2, S3		D6
Market	Long-term customer satisfaction	Possibility of long-term relationship with customers, satisfying needs throughout the products lifecycle	S1, S2, S3,	T3	D6, D8
	Changing customer demands	Possibility to satisfy changing customer demands (i.e., increase demand of sustainable products and responsible companies; acceptance of access instead of ownership)	S1, S2, S3, S4, S5, S6, S7, S8, S9	T1, T3	D3, D4, D5, D6
Technical	New technological opportunity	Opportunity to use recent technological developments and digitalization trends for business innovations.	S2, S3, S4		D1, D5, D7, D8
Organizational	Corporate sustainability	Sustainability and circularity are integrated into the corporate strategy, goals and culture.	S1, S2, S3	T1, T3	D1, D6, D8

Note: The table includes identified presence in the cases studied. See Appendix A for illustrative quotes on each driver.

(22 and 19 identifications, respectively). The most common value chain barrier was 'immature reverse logistic systems' (eight cases), followed by 'operational uncertainty' (seven cases), while the two financial barriers more often encountered were 'financial uncertainty' and 'high initial investment costs' (seven cases each). Even though legal barriers were only the fourth most relevant category, the specific barrier of 'lack of were only the fourth most relevant category, the specific barrier of 'lack of legislative support' was the most often encountered barrier identified in our cases.

4.3 | Comparison between CBMI types

This section presents the main results of our comparison of identified drivers and barriers per each of the three discussed CBMI types. As previously mentioned, the presented results should be further validated in more considerable quantitative research.

4.3.1 | Drivers

Our data suggest that the more relevant driver categories for CBM transformations were market and organisational drivers, while for both CBM diversifications and circular start-ups, these were focused on financial and market drivers. This indicates, first, that three CBMI types were highly driven by the need to adapt to a higher demand for more sustainable products. Second, while CBM transformations were strongly driven by strategic renewal towards sustainability, CBM diversification and start-ups were most commonly aiming for financial benefits, usually in the form of business growth and cost reduction. What is more remarkable about this finding is that within the financial drivers, our data suggest that CBM transformations were particularly driven by long-term business resilience and not necessarily by new sales and reduction of costs. This reflects the long-term orientation of transformations in comparison with start-ups or diversifications, which usually depend on higher market traction with a positive financial return to take off.

Regarding legal drivers, it is interesting to note that regulatory push or legal compliance were not particularly relevant drivers for any of the three CBMI types and were not even mentioned in the transformation cases. And finally, in terms of technical drivers, new technological opportunities seemed to be relevant for start-ups and diversifications but not at all for transformations.

4.3.2 | Barriers

In all three studied CBMI types, several financial and market barriers were identified, though with an uneven focus on specific barriers, as

TABLE 3 Description of barriers for circular business model innovation

Category	Barrier name	Short description	CBM start-up	CBM transformation	CBM diversification
Financial	High initial investment costs	Development and implementation of some circular business models (e.g., PSS) require high upfront investments	S4, S5, S6, S9	T1, T2	D3
	Shareholder short-term orientation	Traditionally shareholders of large firms have a short-term orientation misaligned with the required long-term perspective of the circular economy.	S2, S3, S4		D3
	Financial uncertainty	Associated risks in financial return	S5, S6, S9	T2	D3, D4, D6
	Pre-existing investments	The expected return from significant investments (e.g., infrastructure) that is exposed to risk with the implementation of a new circular business model		T2	
Legal	Lack of legislative support	National or international legislation that hinders the implementation of circular economy practices	S1, S2, S3, S4	T1, T2	D1, D2, D3, D4, D6, D7 D8
	Restrictive product regulations	Legal product requirements that prevent sales or certain applications of feasible CE-oriented products	S1	T2, T3	D6, D7
Market	Affordability vs. sustainability	Consumers' prioritization of affordability over sustainability hinders the introduction of some CE-innovations			D3, D8
	Lack of social awareness	Society being unaware of the sustainability implications of their consumption decisions		T2	D1, D4, D7, D8
	Lack of customer demand	Insufficient demand or acceptance of a product or a service	S2, S3	T1, T2	D3, D6, D8
	Lack of standardisation	Lack of technical, quality, or legal standards, and thus lack of a market, particularly for secondary raw materials	S1, S2, S4		D4, D8
	Prices not reflecting true costs	Market prices do not account for environmental and social externalities, which results in cheap virgin materials and competition challenges.		T1, T2	D6
	Competition with efficient linear system	Challenges of competing against an established system and business model that has incrementally improved their efficiency through time			D6, D8
Technical	Technical trade-offs	Trade-offs between desired product performance categories (e.g., increase in recyclability that reduces the lifespan of a product; satisfying a customer need that decreases environmental performance)			D4, D6
	Technical barriers	Technical barriers preventing implementation of CE-BMs (e.g., product recyclable at laboratory scale but not at market scale)		T2	D2, D4
Organizational	Lack of internal competencies or knowledge	Lack of organizational capabilities and knowledge to deal with circular economy (e.g., definitions, strategy implications, technical know-how, sustainability impacts)	S2, S4, S9	T2	D4

TABLE 3 (Continued)

Category	Barrier name	Short description	CBM start-up	CBM transformation	CBM diversification
	Lack of leadership towards the CE	Lack of support from top executives towards the circular economy		T2	
	Organizational ambidexterity	Challenge of managing the current business model while developing a new business model. This might produce intra-organizational tensions and fear of cannibalization.		T2	D3, D5, D6
	Organizational transformation challenges	Challenges related to preparing, managing and reinforcing the required organizational change			D2
	Lack of experience with the new circular business model	Lack of experience dealing with the new circular business model and its organizational and operational implications			D3
	Organisational	Internal resistance to change due to past success of 'linear' model or due to locked-in culture, investments or structures		T2	D2, D4, D6, D8
Value chain	Difficulties in coordinating the value network	No clear responsibilities or challenges in coordination between multiple contact points	S5, S6, S7		D7, D9
	Heterogeneity of post-consumer waste	Heterogeneity of post-consumer waste in certain industries complicates closing or extending material loops			D3
	Operational uncertainty	Uncertainty related to material flows consistency, quantity, quality or delivery times	S1, S2, S3, S4	T1	D3, D6
	Immature reverse logistics systems	Challenges in developing or improving reverse logistic systems. This task requires specific capabilities in dispersed and complex value chains.	S1, S2, S4, S5, S6, S7		D3, D7
	Traceability & trust challenges	Challenges related to traceability of products and materials through the value chain and trust-building between partners			D3

Note: The table includes identified presence in the cases studied. See Appendix A for illustrative quotes on each barrier.

explained in the next paragraphs. Legal barriers are also highly prominent in all three types, being 'lack of legislative support' the most often encountered specific barrier. Both technical and organizational barriers were found in transformations and diversifications but almost not in start-ups, and value chain barriers were mostly encountered in start-ups and diversifications cases but less common transformations.

Four relevant insights concerning specific financial barriers were observed. First, financial uncertainty was evenly identified as a relevant issue in one-third of all cases across categories, reflecting a regularly found concern in any type of disruptive innovation. Second, high initial investments were identified as a prominent barrier in start-ups and transformations, not so in diversifications, indicating a usual issue found in start-ups and the high cost of a profound strategic renewal. This is also reflected in that pre-existing investments were a barrier only present in transformations, indicating the large scope of this innovation type. And fourth, shareholder short-term orientation was only an issue in diversifications and start-ups and not in transformations, which again reflects the long-term vision requirements of business model transformations.

Regarding specific market barriers, it is valuable to note that the lack of customer demand affected transformations proportionally more than the other types and that the lack of social awareness was an issue for both diversifications and transformations, though not for start-ups. This probably indicates the higher connection start-ups have with emerging sustainability challenges and customer needs.

Organizational barriers were commonly encountered in both transformations and diversifications, though almost not identified in start-ups, which can reflect that circular start-ups are 'born' with a circular mindset, often led by a sustainability-oriented founder and do not have to deal with aspects such as organizational inertia,

ambidexterity or organizational change challenges. Our interviews suggest, though, that start-ups once they start scaling may also encounter some organizational barriers. Similarly, no technical barriers or technical trade-offs were identified in the start-up cases studied, though present in the diversification and transformations cases. Concerning value chain barriers, as previously introduced, these were mostly encountered in start-ups and diversifications, with only one transformation case mentioning 'operational uncertainty' as a challenge.

Lastly, we note that CBM acquisition has been underexplored in this study. However, we raised this topic with several circular start-ups interviewed. Roughly a third of circular start-ups told us they would never consider a merger or acquisition, whereas 2/3 shared that they optimise their business model concerning a potential CBM acquisition and that they would sell to an investor that shared their vision regarding the CE and would bring additional operational benefits. Future research (in the next 2–3 years) could explore if larger incumbent firms have acquired any circular start-ups.

5 | DISCUSSION

This section discusses the key findings of this study and other relevant insights in light of extant literature.

The first relevant reflection is that our empirically identified drivers and barriers correspond significantly with those identified in the literature. The identified drivers largely coincide with those already identified in the literature (e.g., Brown et al., 2019; Tura et al., 2019). The barriers identified in this study confirm the wide range of barriers identified in the literature (e.g., Bressanelli et al., 2019; Govindan & Hasanagic, 2018). This is relevant to validating our empirical exploration and supporting previous explorative studies. Interestingly, there is also a similarity in terms of the distribution of named drivers and barriers. And as in this study, most of the literature identifies more barriers than drivers.

A second interesting aspect is identifying which factors identified in previous literature were not found in this study and which we suggest are appropriate complements to our list of drivers and barriers for CBMI. Relevant is to consider factors related to information and collaboration, which can be added. For example, insufficient information sharing (Bressanelli et al., 2019; Brown et al., 2019; Tura et al., 2019) and lack of data on the environmental impacts of CBMs (Galvão et al., 2020; Rizos et al., 2016) are often seen as barriers. Collaboration in the value chain can be both a barrier (Bianchini et al., 2018) and a driver, serving as a 'facilitator for knowledge availability and technological resources' (Tura et al., 2019).

As a third relevant insight, we consider that our case studies also partly confirmed the advantages of an ecosystem over a conventional organisational or business unit perspective for CBMI, as hypothesised by Geissdoerfer et al. (2020) and Kanda et al. (2021). We had a range of cases in our sample whose circular strategies could only be implemented as part of a wider value network. For example, T3 does not perform any circular value creation activity in-house but instead purchases recycled material, resells production waste to its suppliers and produces a product of 100% recyclable material as part of a circular value network.

6 | CONCLUSIONS

This section provides a concise summary of the study before outlining their contribution to theory and implications for industry and policy practitioners. The paper concludes by explaining the critical limitations of the research and providing recommendations for further research avenues.

The transition to a sustainable system of production and consumption requires the implementation and scaling up of more sustainable and CBMs in the market; however, to comprehend the different drivers and barriers faced by private organisations, there is a need for more empirical data and to understand them from actionable managerial perspectives, of interest, that firms can enter the CE as circular start-ups, diversifying their operation with a new CBM, transforming their current business model with CE practices or acquiring an external CBM. Thus, through a multiple-case study on 21 firms, we identified 25 barriers and 10 drivers clustered in seven categories. Through cross-case analysis, we explored how they distinctively affect the different types of CBMI.

This study has contributed two major aspects to the literature on drivers and barriers for CBMs. First, it has provided novel empirical insights that have complemented the current limited knowledge on the topic, answering calls from previous articles. Second, it is the first article on barriers and drivers for CBMs that have contrasted factors between three of the four types of CBMI, providing an additional analysis perspective.

Our study has several actionable managerial implications, pointing out how, in implementing novel CBMs, specific factors affect start-ups to incumbents and incumbents following a diversification or a transformation strategy. Concerning the motives driving these processes, we argue that while start-ups and corporate diversification are predominantly driven by business growth, cost reduction and changing customer demands, incumbents' business model transformations are led by changes in corporate sustainability strategy, long-term business resilience and adaptation of market demands towards more sustainable products. We identified the different challenges faced; first, that lack of legislative support, high initial investments and financial uncertainty are highly relevant barriers affecting both start-ups and incumbents. Second, while corporate diversifications and transformations more commonly face market barriers—such as lack of demand or social awareness—and organisational barriers—such as organisational inertia, ambidexterity and change challenges— start-ups are more prone to find value chain barriers—such as immature reverse logistic systems, operational uncertainty and value network coordination challenges. We hope that these insights might serve practitioners leading the transition towards a more sustainable and circular socio-economic system.

Our findings indicate that there are levers on different levels of the phenomenon, from operational and functional considerations over strategic decisions to industry, economic and policy issues. This multi-level perspective on drivers and barriers should be acknowledged and considered by industry and policy practitioners. While, as discussed in the following, these findings must be researched further to build a solid basis for decision-making on all levels, our research already indicates areas of interest and potential impact levers for practitioners.

Our study is subject to certain limitations common in an explorative qualitative multiple-case study method (e.g., Eisenhardt, 1989; Eisenhardt & Graebner, 2007; Yin, 2013). First, with 21 cases from 15 industries, our sample is too narrow to deduct generic rules. While this is compensated by triangulation with the existing literature on drivers and barriers in related fields, additional research is needed for further generalisation. Second, the most relevant data were collected through interviews, thus containing self-descriptions of representatives of the cases. This implies that information could have been biased on their subjective theories, representing the viewpoint of some participants of the CBMI case. This issue was aimed to be addressed by explicitly selecting interviewees with an in-depth knowledge of the case and through triangulation of relevant data with publicly available information and field notes. Third, considering we made open-ended questions regarding drivers and barriers, a factor not mentioned in an interview does not imply that it was not present in the case, which limits the validity of our factor relevance suggestions. Finally, we could not include CBM acquisition cases in our sample, which leaves a blind spot in our comparison of CBMI types.

Based on these limitations, we recommend the following avenues for further research. First, we recommend validating and enriching our findings with more cases. These cases should comprise different industries, company sizes, geographies, etc., and significantly additional cases in CBM acquisition—whether similar drivers and barriers are at play or whether the resource efficiency gains mainly depend on the success of integration and the associated realisation of synergies—and along with the CBM strategies: intensification and dematerialisation, which were underrepresented in our sample. Our list of identified factors, the comparison between CBMI types and the factor relevance proposal could be considered for future quantitative studies aiming to validate and generalise results.

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APPENDIX A

TABLE A1 Illustrative quotes of each driver for circular business model innovation identified

Category	Driver name	Illustrative quote
Financial	Business growth	'Taking back equipment and refurbishing it, actually helps to drive new sales. It creates a new market segment, and it helps to keep existing customers loyal.' (Senior Director Sustainability, D6)
	Business resilience	'We work on our future resilience. The fact that we are already 50% not depending on fluctuating prices, on scarcity, on fossil fuels as such, is also interesting for our shareholders.' (Head of Sustainable Development, T1)
	Cost reduction	'It was mainly about the costs, to find new ways of sourcing materials. And if you are looking to decrease the cost of raw materials, you need to take a deeper look into the waste and into renewable materials.' (Country Sustainability Manager, D2)
	Resource scarcity	'(…) 15–16 years ago, we found that at that pace of selling and growing, with heavy commercial success, we will run into issues with our raw material. Where do we get our raw material?' (Country Sustainability Manager, D2)
Legal	Regulatory push	'Another important point is the circular economy package. This is very good for us. (…) If there is regulation which forces countries more in the direction of the CE, of recycling, is good for us, because we have the solutions to do this.' (Head of Product Management, D5)
	Legal compliance	'We know that the amount of plastics in products is going up. And we also know that the recycling targets in the WEEE directive are going up. If we want to continue to reach those targets going forward, we've got to make sure that the plastics get recycled.' (Senior Director Sustainability, D6)
Market	Long-term customer satisfaction	'We typically sell systems. We deliver a system, hand it over to the customer, and the relationship can potentially end there. Sometimes we do maintenance. If you have a service performance-driven contract, then you have a different kind of relation. You can keep on adding value to customers.' (Director Strategy & Sustainability, D8)
	Changing customer demands	'We see a shift to other things we already have in the portfolio and other things that 10 years ago no one was interested in. They are fulfilling sustainability and circularity requirements. So, things we had on the shelf for 5 years, finally have a market.' (VP Group Sustainability, D4)
Technical	New technological opportunity	'The idea was from two managing directors of the company that were former technology managers, in big IT companies. They were not in the waste management business at all. (…) They said, "What new technologies can we handle and what can we do?"' (Managing Director, D1)
Organizational	Corporate sustainability	'The company has a real focus on sustainability and circular economy. This is coming from the shareholders and our CEO. (…) We need to do something for the environment, and Circular Economy is walking the talk.' (Managing Director, D1)

TABLE A2 Illustrative quotes of each barrier for circular business model innovation identified

Category	Barrier name	Illustrative quote
Financial	High initial investment costs	'The take-back program created the idea of leasing. It took us a year to find a bank that was willing to lease carpet tiles, which was extremely difficult.' (Director Sustainability, T2)
	Shareholder short-term orientation	'If we do not show value creation from the existing R&D and their work, we cannot get more investment and interest from the company, which needs to answer to the shareholders, who are very short term oriented.' (Head of Product Management, D3)
	Financial uncertainty	'We are in a situation, where it all costs money, without a certain return on investment'. (Director Sustainability, T2)
	Pre-existing investments	'Why would a company that invested millions of dollars in incineration, stop incinerating? The investment is there, and they are making money. You are not going to stop 30 years of investments so easy.' (Director Sustainability, T2)
Legal	Lack of legislative support	'There are still legal barriers, still the legal framework isn't set up for a CE. Waste legislation is still very national, trying to keep stuff within borders. Within Europe is a bit better, allowing to move some waste, but under strict rules.' (Senior Director Sustainability, D6)
	Restrictive product regulations	'We are making a product that is clean enough to make nutrition in the biological circle, but legislation prevents society to do so.' (Innovation & Business Intelligence Manager, D7)
Market	Affordability vs. sustainability	'(…) the industry, being partly very cost-sensitive consumers, still claiming that they care about sustainability, but on the point of sale they made their buying decisions based on the price only.' (Senior Manager Sustainability Integration, D3)
	Lack of social awareness	'The biggest challenge is the lack of understanding of these complex things. Last week I was asked what I see as the biggest challenge for Circular Economy for packaging, and I said, in general, besides packaging, it's a matter of education.' (VP Group Sustainability, D4)
	Lack of customer demand	'The challenges were on consumer adoption. Some of the values of the [product name] are during its lifecycle, but not all the customers have a lifecycle approach.' (Director Strategy & Sustainability, D8)
	Lack of standardisation	'There is no market because there is a demand, but the demand is not regulating it, nobody knows who needs it, and in what kind of technical properties. (…) We want to set a market in Europe for secondary raw materials, and a standard to follow.' (VP Group Sustainability, D4)
	Prices not reflecting true costs	'Materials are still too cheap. (…) resources should be much more expensive if you look at the environmental damage they have done. (…) If as a society we manage to price resources at the right level, no one would be talking about the Circular Economy anymore, everyone would be doing it.' (Senior Director Sustainability, D6)
	Competition with efficient linear system	'You are competing against a very effective linear system. The linear system has been optimized for a hundred years, and you are competing with a circular business model that we are trying to figure out now in 5 years.' (Senior Director Sustainability, D6)
Technical	Technical trade-offs	'That's the problem with recyclability, if you want it to be mono-material, you need much more primary material for it. (…) This is not an argument for flexible, or for rigids, it's just that the issue is complex, and you have to look at the overall performance, not only if it's recyclable.' (VP Group Sustainability, D4)
	Technical barriers	'Technology is not prepared for this table example. If you do a product that could be recycled it needs to be designed in a way that it can be recycled in an affordable way.' (Country Sustainability Manager, D2)
Organizational	Lack of internal competences or knowledge	'The first question to my CEO is "what is Circular Economy in your opinion?" because there are 114 different definitions. (…) The majority of people that talk about Circular Economy basically don't know what it means.' (Director Sustainability, T2)
	Lack of leadership towards the CE	'The biggest challenge is the fact that we don't have a CEO that goes with everything he has in that specific direction.' (Director Sustainability, T2)
	Organizational ambidexterity	'We want to rent machines, we want to sell machines, if one business model helps the other great, but we don't want to say that we just have a big fleet only to make demonstrations to buy new machines. Then we would not need a rental fleet, only a demo fleet.' (Head of Product Management, D5)
	Organizational transformation challenges	'Internal stakeholders were the biggest challenge from my perspective. (…) just to bring people, and convince them this makes sense, this is a new business model. For us, as any other retailer: product, pay, buy, go home, final. Extending the business model too much more was tough to understand for a company like us.' (Country Sustainability Manager, D2)

(Continued)

Category	Barrier name	Illustrative quote
	Lack of experience with the new circular business model	'What was different is that we needed to really go out of our comfort zone, our knowledge zone. Normally, even if we do big innovations, we are very much within the supply chain, within our processes. (…) We were doing something totally different for the company, but also for the whole industry.' (Head of Product Management, D3)
	Organizational linear inertia	'This was at the very beginning the main argument from the sales department on why not to do it: We want to sell new stuff; this is our concept, and we don't want to change it. This was a change process that we had to do.' (Country Sustainability Manager, D2)
Value chain	Difficulties in coordinating the value network	'The biggest hurdle to overcome, and it's the reason why none of these combinations have been successful so far anywhere, is that the bigger companies have two contract managers, two running contracts, one for the waste, one for the purchase of hygienic material. These contracts have a running time, they are never synchronous. They are managed by two different people.' (Innovation & Business Intelligence Manager, D7)
	Heterogeneity of post-consumer waste	'But in the post-consumer, it is so different, you might use a t-shirt a hundred times and me only five times, and both have the same cotton quality. How do you mix all these things to make cellulose? And what colour do you have?' (Head of Product Management, D3)
	Operational uncertainty	'Most challenging was to think of everything that might come up. It was like, you have bubbles in the water, but you are on the surface, so you never know when the next bubble might pop up and how it might look like.' (Senior Manager Sustainability Integration, D3)
	Immature reverse logistics systems	'It's not our competence to go to the supply chain, to the brand and then buy material from them. And then, how to arrange the logistics as well. Not only the accounting system of the brand on whether they could sell it or not, that is one thing, but also the reverse logistics and the collection there only for the purpose of recycling.' (Senior Manager Sustainability Integration, D3)
	Traceability & trust challenges	'Circular Economy also needs traceability and transparency. That way, when we go into the next phase of post-consumer products, how do I know what is contained in each of the shirts and jeans I am getting? What type of colour, what kind of materials are in there? I need to know otherwise I cannot process the material.' (Head of Product Management, D3)