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Change agents' cognitive maps of circular supply chain transition – An investigation of barriers, actions, and outcomes

Roger Nyffenegger [a,*], Axel Zehendner [b], Anne M. Quarshie [c], Rudolf Leuschner [d]

[a] Management Science, Innovation, Sustainability and Entrepreneurship (MISE), School of Engineering and Computer Science, Bern University of Applied Sciences, Quellgasse 21, 2501, Biel, Switzerland
[b] Business School, LUT University, P.O. Box 20, 53851, Lappeenranta, Finland
[c] Department of Management and Entrepreneurship, Turku School of Economics, 20014, University of Turku, Finland
[d] Rutgers Business School, Rutgers University, 1 Washington Park, Newark, NJ, 07102, USA

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ABSTRACT

Integrating circular principles into supply chains (SCs) is a significant challenge for many managers aiming to decouple their organizations' activities from the use of natural resources and environmental degradation. Despite increasing research focusing on the circular economy (CE), little attention has been given to individuals' interpretations of the circular transition and their own transition strategies. This interpretivist qualitative study provides insights into the managerial sensemaking of the circular SC transition, including the barriers faced and the strategic actions taken to overcome the barriers and realize desired outcomes. Semi-structured interviews with 19 change agents were combined with a cognitive mapping approach. The individual cognitive structures were synthesized into an overarching sensemaking map that captured the informants' perceptions and social construction of the circular SC transition. The findings reveal four shared cognitive frames (i.e., the most plausible schemes) held by change agents: (1) SC cooperation, (2) circular business models, (3) circular design, and (4) material choice. Moreover, we develop a framework that highlights how sensemaking contributes to the calibration of cognitive frames and the strategies pursued by individuals. We contribute to the literature by providing insights into change agents' social construction and perceptions of the circular SC transition and propose key takeaways for practitioners and policymakers.

1. Introduction

Since the emergence of mass production during the Industrial Revolution, the global economy has been dominated by linear systems following a 'take-make-dispose' pattern (Esposito et al., 2018). These systems operate under the assumption "that there is an unlimited supply of natural resources and that the environment has an unlimited capacity to absorb waste and pollution" (Cooper, 1999, p. 10). This careless consumption of natural resources and environmental pollution have contributed to many socio-ecological crises, such as climate change and biodiversity loss (Salmi et al., 2023; Wright and Nyberg, 2017). To respond to these grand challenges (Ferraro et al., 2015), a departure from linear to circular supply chains (SCs) is required (Tate et al., 2019). The circular economy (CE) is based on the idea that the economic system is embedded in the natural environment, emphasizing the need to minimize resource extraction and environmental harm to ensure the long-term health of both the ecosystem and the economy (Inigo and Blok, 2019; Montabon et al., 2016). Despite the clarity of these overall goals and strategies, questions about implementation remain, specifically how individuals perceive actions and barriers.

The extant literature on circular SCs has focused largely on barriers and enablers (e.g., Govindan and Hasanagic, 2018; Guldmann and Huulgaard, 2020; Vermunt et al., 2019). However, little attention has been paid to the interpretations and actions of individuals, who are often a driving force in transitions toward circularity. Consistent with the common understanding in the change management literature (By et al., 2011), this study focuses on managers, who, as change agents, play a crucial role in developing, implementing, and selling circular initiatives within organizations and along SCs. Studying the sensemaking and interpretations of these individuals is beneficial for understanding how

* Corresponding author.
E-mail addresses: roger.nyffenegger@bfh.ch (R. Nyffenegger), axel.zehendner@lut.fi (A. Zehendner), anne.quarshie@utu.fi (A.M. Quarshie), rleuschner@business.rutgers.edu (R. Leuschner).

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complex circular transitions can be conceptualized and put into practice in SC contexts (Bien and Sassen, 2020; Blomsma and Brennan, 2017; Fiss and Hirsch, 2005; Kuhlmann et al., 2023). Individuals influence the overall strategies of organizations (Hahn et al., 2014) as well as the translation and implementation of specific strategic actions (Balogun et al., 2015; Rouleau and Balogun, 2011). A better understanding of individuals' shared perceptions of the circular SC transition, including perceived barriers and corresponding actions, can help develop more holistic and effective management strategies. Many companies have made early attempts to integrate circular principles into their purchasing practices, SC structures, and processes, but the overall transformation of companies toward circularity is still in its infancy (Farooque et al., 2019; World Business Council for Sustainable Development, 2021). Since change agents are critical in this transition, we believe it is important to study these individuals' interpretations of the circular transition. Insights into these socially constructed transition processes may provide a better understanding of not only the main reasons but also the interpretations that hinder the larger societal shift toward more circularity, despite the popularity of CE as a concept.

To provide a theoretical and practical understanding, our paper seeks to answer the following research question: *How do change agents interpret the circular SC transition?* Specifically, we are interested in the cognitively perceived barriers, corresponding actions to overcome these barriers, and outcomes of change agents with the responsibility of driving and translating the circular transition in organizations and SCs. In our interpretivist qualitative study (Gehman et al., 2018; Quarshie and Leuschner, 2020), we adopt a cognitive mapping approach (Eden et al., 1992; Richter and Arndt, 2018) to study the perceptions of 19 Swiss individuals who are either directly or indirectly involved in the circular transition process of SCs. Building on insights and arguments from sensemaking theory (Weick, 1995), we develop a collective cognitive map that synthesizes four main shared interpretations. These can be understood as the most plausible schemes retained by the change agents as a result of their sensemaking. We then develop a theoretical framework that highlights how sensemaking influences the adoption of cognitive frames and related strategies that enable a transition toward circular SCs.

The main contributions of our paper are as follows: First, we advance research on CE by providing insights into change agents' cognitive perceptions and interpretations of circular SC transitions. This is visualized in the form of a strategic cognitive map (Fig. 2) and a related theoretical framework (Fig. 3). We also provide insights into change agents' perceived enabling actions and the resulting outcomes for overcoming barriers to the circular transition. Second, our study contributes to the research at the intersection of sensemaking theory and sustainable SC management (SCM). Especially when phenomena are ambiguous and new, such as the circular SC transition, the interpretations of individuals play a crucial role in the selection and implementation of presumably appropriate actions. However, most research on SCs in general or specifically on circularity has largely neglected the interpretations of individuals that influence the strategies and practices adopted in SCs. Finally, we make a contextual contribution by directing our focus toward Switzerland, a region where circular transformation processes have only been studied to a limited extent (Stucki and Wörter, 2022). Studying the Swiss context is particularly compelling because of the impact of circularity on the competitiveness of Swiss companies, given their significant dependence on imported resources.

The rest of the paper is structured as follows: First, we introduce the relevant theoretical background of the study. Next, we outline our methodology, including our research approach, data collection, and data analysis. Then, we present our results, including the cognitively perceived barriers, corresponding actions, and outcomes related to the circular transition in SCs. Subsequently, we discuss the results in light of the theoretical background and outline our study's contributions and implications. Finally, we conclude the paper by outlining its limitations and suggestions for future research.

2. Theoretical background

2.1. Circular economy and supply chains

CE is an integral part of today's sustainability efforts (Murray et al., 2017). It emerged from the definition of sustainable development proposed in the Brundtland Commission report (World Commission on Environment and Development, 1987). The concept of CE has its origins in different schools of thought, such as industrial ecology or the cradle-to-cradle concept (Borrello et al., 2020; Homrich et al., 2018). CE remained a niche topic for some time, but it has now become an umbrella term for these related schools of thought (Blomsma and Brennan, 2017). The concept gained momentum through China's national CE strategy and, later on, through those of European industry actors (Lieder and Rashid, 2016; Rosa et al., 2019). CE's benefits are evident within all areas of sustainability: environmental, social, and economical. For instance, Renault committed early to CE strategies by leasing the batteries of its newly launched electric cars (Urbinati et al., 2017). The French car manufacturer managed to recover 43 % of car parts for remanufacturing, and in doing so saved 80 % of energy, water, and chemical products while offering these parts 30–50 % cheaper to its customers (Saidani et al., 2018). Overall, the promises of CE include the creation of new jobs and business opportunities, the development of technological and organizational innovations, and the promotion of economic growth and increased competitiveness of companies and entire SCs (Rizos et al., 2016; Su et al., 2013).

Both research and practice recognize that the actions of single companies cannot achieve the overall goal of CE (De Angelis et al., 2018; Zhang et al., 2021). Generally, more than 75 % of a company's value added is created externally by suppliers and their subcontractors (World Trade Organization, 2021). This means that from the CE perspective, value creation often begins with the energy-consuming extraction of nonrenewable materials and ends with disposal of the product or recycling into further use or reuse. The implementation of CE will not succeed without embedding the supply and demand sides of the SC (Ferasso et al., 2020). Therefore, supplier management and other purchasing activities play an important role in the transformation toward the CE (Münch et al., 2022; Neessen et al., 2021). Simultaneously, circularity has numerous implications for creating and managing SCs, which is why the term 'circular SC' has emerged (Batista et al., 2018). For example, circular SCs can form a part of sustainable SCM (Walker et al., 2021). The origins of the circular SC concept can be traced to 'reverse logistics' (Rogers and Tibben-Lembke, 2001; Quarshie et al., 2016), and it has evolved further to incorporate 'closed-loop SCs' (Govindan et al., 2015; Suzanne et al., 2020).

A circular SC represents the transition from a linear and sequential to a circular flow of resources and products from the ultimate source to the final and last possible consumption, including possible recycling and reuse (Bocken et al., 2016; Kirchherr et al., 2017; Tate et al., 2019). Through the establishment of circular SCs, the goal is to enable a regenerative economy that preserves existing resources and adds little 'primary' resources to the stream of creating products and services (Howard et al., 2019; Salmi et al., 2023). The benefits derived from the revised flow of resources and products over the life cycle of a product include reduced material and energy consumption (Morseletto, 2020). Circular SCs stand for the ethical use of the earth's resources and green inter-company value creation (González-Sánchez et al., 2020). For example, a circular SC can involve creating value by integrating traditional SC activities into new types of business models (Geissdoerfer et al., 2018). Ultimately, circular SCs can be considered ethically

conscious choices that help support a sustainable future.

2.1.1. Actors involved in the circular economy and supply chains

Various actors are involved in CE and SCs (Batista et al., 2018). There is a consensus in the literature that the concept of CE must not stop at the boundaries of an individual company (e.g., De Angelis et al., 2018; Genovese et al., 2017; Masi et al., 2017). Instead, SCs must be explicitly included in this conceptualization (Geissdoerfer et al., 2018). Apart from the focal organization and its various functional areas, customers and suppliers must be considered during the circular transition (Govindan and Hasanagic, 2018; Leuschner et al., 2013). Nontraditional SC actors also influence the circular transition. These actors predominantly include governments, nongovernmental organizations, and civil society at large (Pagell and Shevchenko, 2014; Quarshie et al., 2016).

Although the transition toward CE asks for changes from organizations and SCs as a whole, individuals are responsible for driving the circular transition in the organization (Koistinen et al., 2022). Managers and leaders, who serve as translators and planners of organizational change, have different impacts on the outcomes of strategic decisions and the directions that organizations and entire SCs take (Nordin et al., 2018; Penttilä et al., 2020). Whereas top management leadership is typically responsible for the formulation of corporate strategies, middle managers are usually the main actors who determine the quality of the implementation (Raes et al., 2011). Middle managers play a particularly important role during periods of change because they are often responsible for translating strategic objectives into actions and practices (Floyd and Wooldridge, 1994, 1997; Huy, 2011). Individuals are responsible for the interpretation and 'selling' of strategic change not only to themselves but to other actors as well (Rouleau, 2005). Moreover, it is commonplace for organizational changes to rely on a host of external service providers, such as consultants (By et al., 2011). Insights into the perceptions of relevant individuals are hence crucial for comprehending how CE can be achieved (Balogun and Johnson, 2004; Wade and Griffiths, 2021). However, the individuals responsible for developing and implementing circular strategies and actions have been largely neglected in prior research (for exceptions, see Bozkurt et al., 2022; Koistinen et al., 2022).

2.1.2. Circular economy drivers and barriers

Many drivers provide incentives for companies and their SCs to adopt CE activities (Govindan and Hasanagic, 2018; Hina et al., 2022). One group of drivers stems from the governmental policy domain. These cover guidelines and regulations, such as taxation, supporting funds, and subsidy policies promoting cleaner production, consumption, and end-of-life management (Hina et al., 2022; Ilić and Nikolić, 2016; Urbinati et al., 2021). In the social area, education is a driver for CE because people with higher education are more prone to buy products with recycled content (Neves and Marques, 2022). Similarly, increasing awareness and concerns among consumers about global sustainability trends also act as social enablers of CE (Baldassarre et al., 2020; D'Agostin et al., 2020). From an SC perspective, the geographical proximity of SC partners has been identified as an enabling factor for CE because it promotes open communication and cooperation, which subsequently improves the availability of resources (Calicchio Berardi and Peregrino de Brito, 2021; Urbinati et al., 2021). Moreover, stakeholder pressure plays a major role as a CE driver because stakeholders demand more responsible production and consumption (Russell et al., 2020).

Beyond external drivers, the literature also identifies several company-internal factors that enable CE transitions. Good leadership, for example, is seen as the most important element for the successful implementation of (CE) business models (Hina et al., 2022; Moktadir et al., 2020). Moreover, knowledge as a resource can enable the implementation of CE business models (Ilić and Nikolić, 2016). There are also several drivers related to product and process development, which can be relevant in the areas of product longevity, waste recovery, and SC redesign, among others (Cui et al., 2017; Gusmerotti et al., 2019; Hussain and Malik, 2020).

The slow progress in implementing and adopting CE principles results from numerous barriers preventing CE from flourishing (Werning and Spinler, 2020). CE barriers can be conceptualized in different ways. However, no single categorization has so far been adopted as the predominant framework in this area (e.g., Hina et al., 2022; Linder and Williander, 2017; Ormazabal et al., 2018; Rizos et al., 2016). Besides differentiating barriers along the system levels of micro, meso, and macro (Pheifer, 2017), the classification of cultural, regulatory, market, and technological barriers is commonly used (de Jesus and Mendonça, 2018; Kirchherr et al., 2018).

Several barriers are predominant from a company's internal perspective. Lacking intra-company collaboration, characterized by uncoordinated objectives, processes, and budgets among departments, hampers the CE transition (Pheifer, 2017; Werning and Spinler, 2020). The literature also identifies non-holistic approaches within the company itself as an important barrier (Hina et al., 2022). This goes hand in hand with the lack of a long-term circular strategy that considers the necessary high upfront investments and long payback periods (Lacy and Rutqvist, 2015; Pheifer, 2017). Additionally, organizations are simply aligned on linearity, in which purchase activities, quality management systems, accounting rules, and internal policies, for example, prevent circularity (de Jesus and Mendonça, 2018; Kirchherr et al., 2018). Companies may also fear the cannibalization of their existing linear business that secures profits in the short-term (Linder and Williander, 2017; Werning and Spinler, 2020). The overall complexity of the product, non-suitability of its design for reuse, challenges with maintenance and/or disassembly (Ghisellini et al., 2016), or lack of CE knowledge and skills (de Jesus and Mendonça, 2018) are the main barriers in (internal) operations. A barrier may also be that reverse SC infrastructures are not present (Dutta et al., 2021; Rizos and Bryhn, 2022) or are unstable due to fragile return and collection systems (Werning and Spinler, 2020). Reuse and remanufacturing processes may also face lump demand and geographical dispersion of activities (Bressanelli et al., 2017; Rizos and Bryhn, 2022).

Overall, the extant literature has identified a broad range of CE drivers and barriers, but there remains little understanding of how individual CE change agents make sense of the various CE barriers that they face and especially how their perceptions influence their firms' actions and the outcomes of those actions.

2.2. Sensemaking literature

Sensemaking is a procedure that individuals apply to process issues and circumstances that are new, confusing, or, in some way, violate their existing beliefs and expectations (Weick, 1995). For example, in an organizational context, individuals can try to clarify moments of uncertainty, ambiguity, complexity, or equivocality by extracting and interpreting cues from their environment (Maitlis and Christianson, 2014; Townsend et al., 2018). By engaging in a continuous process of seeking and making sense, actors develop assumptions, expectations, and understandings of an issue that further shape their actions (Gröschl et al., 2019; Wade and Griffiths, 2021; Wang et al., 2019). This type of continuous and reflective interplay of actions and interpretations is especially crucial when organizational members are confronted with unanticipated phenomena or radical changes (Quarshie et al., 2021; Waddock, 2019).

An almost infinite flow of events and experiences surrounds any organizational player (Chia, 2000; Weick et al., 2014). For example, companies and managers are increasingly pressured to transform SCs toward sustainability and circularity, leading to ambiguous situations (Kocabasoglu et al., 2007). Organizations may be expected to establish repair services, create reverse SCs, or introduce new materials and technologies. In response to such events and interruptions, managers generally ask themselves, "What is going on here?" and "What do I do next?" (Weick et al., 2005, p. 412). The so-called enactment phase

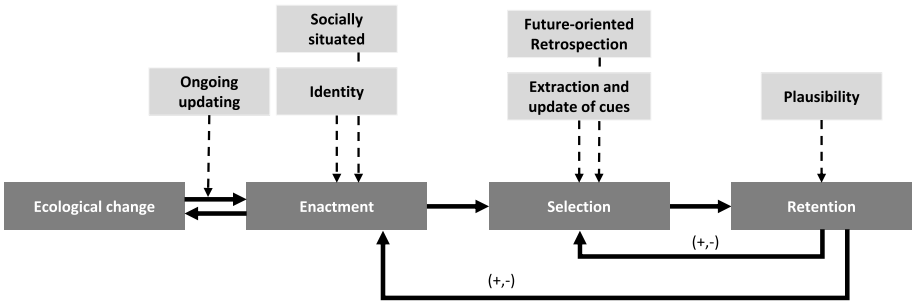

Fig. 1. Weick's sensemaking model, own illustration adapted from Cristofaro (2022) and Weick et al. (2005).

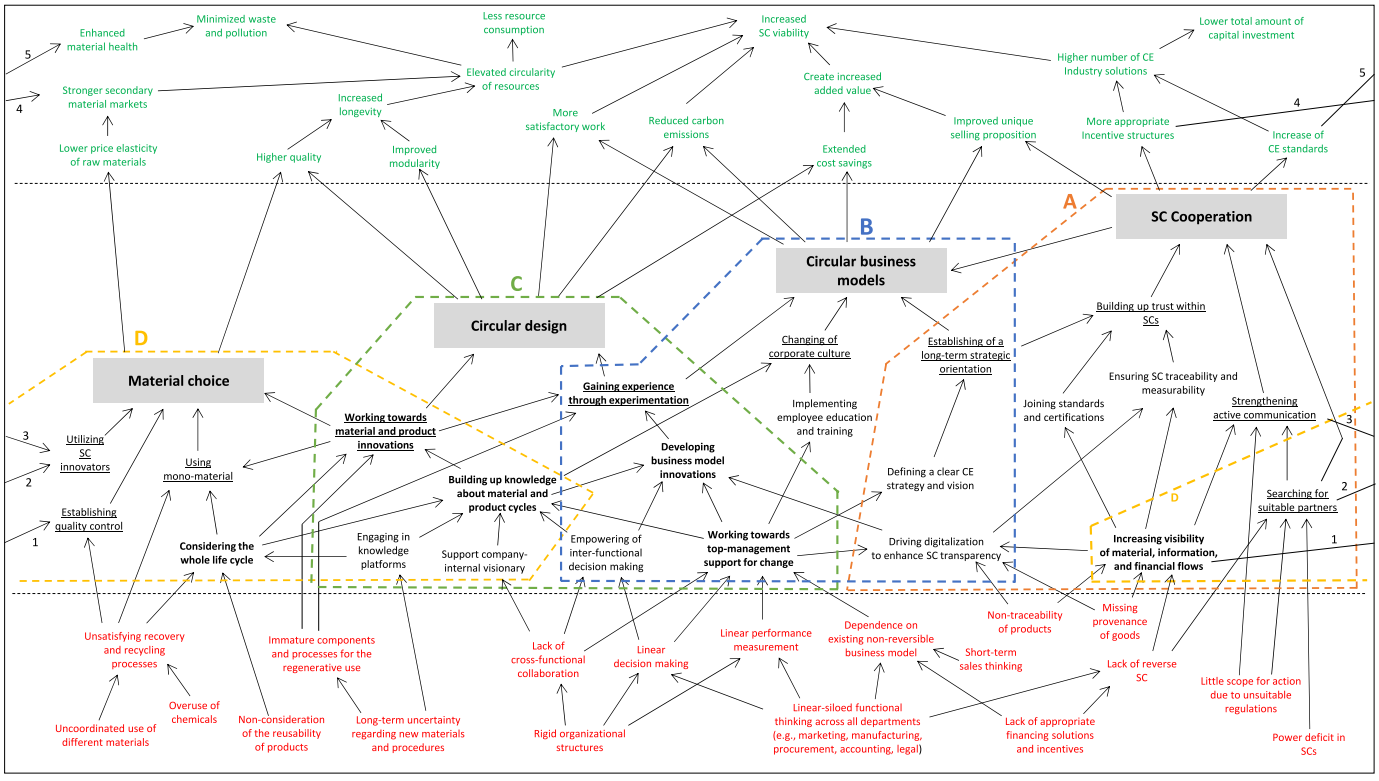

Fig. 2. Strategic map.

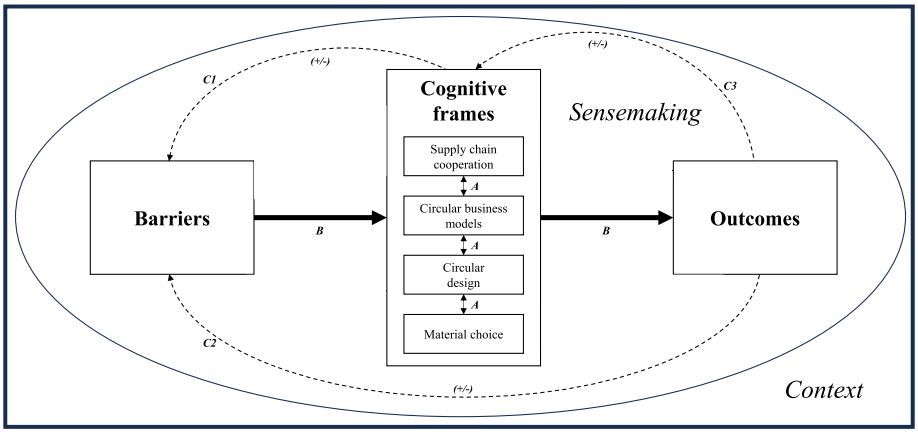

Fig. 3. Theoretical CE sensemaking framework.

(Fig. 1) entails, first, the filtering of the grouped cues on which sensemaking initially acts and, second, the extraction of new cues emerging from the ongoing situation (Cristofaro, 2022). In this context, sensemaking helps label and classify undifferentiated flows of sense impressions that an individual is exposed to on an ongoing basis (Weick et al., 2005). Thereby, the identity of the organizational agents but also the social situation within which they act influences the sensemaking process (Cristofaro, 2022). Events and inputs around the circular SC transition may similarly be identified, categorized, and routinized to create a sense of stability, order, and predictability about them (Chia, 2000).

As part of sensemaking, meaning is created by connecting observed events and inputs with existing frameworks (Wang et al., 2019). This second phase is called selection (Fig. 1), where ambiguity is reduced by making sense of a situation by drawing on schemata, mental maps, or representations (Cristofaro, 2022; Maitlis and Christianson, 2014). For example, a procurement manager may start to observe materials that allow circularity, or a sales manager may begin to recognize the increasing demand for repair services. This type of enactment happens deliberatively and in recursive cycles. As managers interpret the gained understanding of the events and inputs with existing frameworks, the same frameworks are simultaneously questioned and tested, considering new frameworks and alternative interpretations (Weick et al., 2005). Finally, actors may develop a common understanding or view of things through discussions with others, with the most plausible schemes retained in the retention phase (Fig. 1) (Cristofaro, 2022; Quarshie et al., 2021; Taylor and Van Every, 1999). In this paper, we integrate insights from sensemaking theory to theorize how CE change agents perceive the barriers they confront related to circular SC transitions and how these plausible schemes influence the actions and outcomes that they adopt in circular SC transitions (Ciulli et al., 2020; Esposito et al., 2018).

3. Methodology

3.1. Research approach and context

We utilized an interpretivist qualitative research approach (Gehman et al., 2018) combined with a cognitive mapping approach to gain deep insights into the managerial perceptions of the transition toward circular SCs. Qualitative methods, including the chosen interpretivist epistemological perspective in this research, are suitable for understanding complex topics from the perspectives of relevant actors, such as change agents (Koistinen et al., 2022; Quarshie et al., 2021; Schwartz-Shea and Yanow, 2012). Although interpretivist research has traditionally been less common in the purchasing and SCM field than case-based qualitative research, an increasing number of studies have recently started to employ interpretive grounded theory methodologies to build theory (e.g., Quarshie and Leuschner, 2020; Villena and Gioia, 2018). A particular strength of interpretive theories is that they typically seek to capture the sense given by research participants to a phenomenon (Gehman et al., 2018). The cognitive mapping approach is an analytical technique that can be used to understand how managers perceive certain phenomena (Richter and Arndt, 2018). The findings of the research technique are generally summarized in cognitive maps that are typically derived through interviews, where the subjective, socially constructed world of an interviewee (or multiple interviewees) is presented (Eden, 2004; Eden and Ackermann, 1998). Since the CE research field is emerging (Murray et al., 2017; Ritala et al., 2018), we considered the combination of semi-structured interviews with a cognitive mapping approach as a suitable research strategy for understanding the individual and collective sensemaking of the core phenomenon.

We chose Switzerland as the study's empirical context for two main reasons. First, the country's economy is mature, with a well-developed infrastructure, causing lock-in effects and barriers that may hamper the circular transition. Second, the country is largely dependent on imports, which has not yet led to a comprehensive shift to CE among companies and their SCs (Stucki and Wörter, 2022). The closed-loop material utilization rate in the country is so far only 13 % (Bundesamt für Statistik, 2020), which suggests that there remains significant potential to further develop CE activities. As such, we expected to have access to CE change agents from various industries that are actively seeking CE activities in their SCs. We consider change agents to be individuals who advance and work on CE-related issues in a company or a supporting organization. By interviewing change agents, we aimed to derive individual and collective cognitive maps that captured a range of perspectives and mental representations related to the barriers, enabling actions, and outcomes of transitioning toward circular SCs.

3.2. Data collection

We chose semi-structured interviews to generate data about the insights of a diverse group of managers identified as change agents involved in the circular SC transition. The interpretivist research relied on semi-structured interviews due to their potential to generate deep-level contextual insights into how the circular transition is understood and interpreted by the selected experts (Bogner and Menz, 2009; Corbin and Strauss, 2015; Gehman et al., 2018). Expert interviewees enabled us to explore the complex core phenomenon and dissect the topic in all its facets (Scapolo and Miles, 2006; Wang et al., 2019).

The pool of interviewees was based on pre-specified selection criteria (Corbin and Strauss, 2015; Pratt et al., 2020). These criteria concerned the following: (1) the track record of the change agents' organizations, which manifests in aspects such as the proven realization of circular projects, the portfolio of circular products (e.g., with Cradle to Cradle certification), or membership in a CE network; (2) the significance and responsibility of the change agents' role in driving the circular transition, which may or may not coincide with the hierarchical position; and (3) their willingness and availability to participate in the research. Managers who met these criteria were initially approached through cold calling. The sample of research participants was later expanded through snowball sampling.

The change agents included in our final sample (Table 1) represented diverse industry backgrounds, job positions, and organizational sizes. At the time of our data collection, these individuals were directly or indirectly involved in the circular SC transition and could be classified into two groups. The first group (eleven individuals) includes people in organizations transitioning to products and/or business models aligned with the CE concept. The second group (eight individuals) includes people in the organization who support its transition toward circular business models and SCs (e.g., consultancies, certifiers, and CE initiatives). Overall, we believe that this selection of change agents represents a suitable theoretical sample. The heterodox but purposefully selected interview sample helps us to provide rich and relevant insights into the circular SC transition by capturing the perspectives and understandings of change agents with diverse backgrounds and experiences.

We continued conducting interviews until we gained diverse perspectives and were confident that we had reached theoretical saturation. This was evidenced by the limited added information surfacing in the new interviews. Toward the end of the data collection, we determined that we had enough data to fully develop and refine the constructs of our final theoretical model (Corbin and Strauss, 2015). A total of 19 semi-structured interviews with the selected CE change agents were carried out by one researcher between September and October 2020. The interviews took place either in person or online and lasted between 60 and 120 min. All interviews were recorded with the consent of the participants. An initial interview guide (see Appendix 1) was developed to trigger the sensemaking of the selected change agents prior to beginning the interviews. The first section concerned the interviewees' organizations, positions, and primary responsibilities. The second section sought to determine the interviewees' definitions and general understandings of the CE concept. In addition, the interviewees were asked about their organizations' motivations to transition toward circular SCs and about their stages of CE implementation. The third section focused

Table 1
Change agent sample overview.

No.	Organization	Position	Industry	Revenue	Company size
A.	CE Certification and Consulting Company[b]	CEO and Owner	Consulting	N/A	Small 11–50 employees
B	Construction Company and Real Estate Developer [a]	Project Leader CE Strategy	Construction, Real Estate	800 M CHF	Large low 501–1′000 employees
C	One of the largest Retail Companies in Switzerland [a]	Team Leader Ecology Non-Food	Retail	29.9 B CHF	Large high +10′000 employees
D	Foundation supporting Companies solving Environmental Tasks[b]	Project Leader CE	Nonprofit	N/A	Small 11–50 employees
E	Startup producing Recyclable Bottles [a]	CEO and Founder	Consumer Goods	N/A	Micro 1 employee
F	Family-owned Manufacturer of Printing Products and Marketing Service Provider [a]	Managing Director	Marketing & Advertisement	N/A	Mid-size low 51–200 employees
G	Internationally active Swiss Furniture Manufacturer [a]	Group Product Development Director	Furniture	200 M CHF	Mid-size high 201–500 employees
H	Family-owned Swiss Baked Goods & Biscuits Producer [a]	Head of Sustainability	Food Manufacturing	110 M CHF	Mid-size high 201–500 employees
I	Knowledge and Network Platform for CE in Switzerland[b]	Project Manager	Nonprofit	N/A	Micro 2–10 employees
J	One of the world's largest Apparel, Footwear and Accessories Company [a]	Senior Product Development Manager Sustainability	Clothing and Fashion	10.5 B USD	Large high +10′000 employees
K	One of the world's largest Service Providers of Management and Strategy Consulting[b]	Strategy Manager	Consulting	39.6 B USD	Large high +10′000 employees
L	Support Fund that identifies, enables, and accompanies Pioneering Projects[b]	Project Leader CE & Mobility	Nonprofit	N/A	Small 11–50 employees
M	Association to realize the CE for Packaging in Switzerland[b]	Managing Director	Nonprofit	N/A	Micro 2–10 employees
N	Internationally active Swiss Parquet Flooring Manufacturer [a]	Director Total Quality Management	Furniture	145 M CHF	Large low 1′001–5′000 employees
O	Multinational Furnishings Group [a]	Head of Sustainability Switzerland	Retail	39.6 B EUR	Large high +10′000 employees
P	Startup producing Ethical Fashion [a]	CEO and Co-Founder	Fashion	N/A	Micro 2–10 employees
Q	Family-owned Construction Company active in Engineering, Demolition, Recycling and Remediation of Contaminated Sites [a]	Division Head Development	Construction	120 M CHF	Large low 501–1′000 employees
R	Knowledge and Network Platform for CE in Switzerland[b]	Innovation & Start-up Project Manager	Nonprofit	N/A	Small 11–50 employees
S	Leading Business Conference in Switzerland[b]	Project Leader CE2	Event Services	N/A	Small 11–50 employees

[a] managers in organizations transitioning to products and/or business models aligned with the CE concept.
[b] supporters and facilitators of companies transitioning toward circular business models and SC.

on the perceived barriers to circular SC transitions. It aimed to determine how the change agents identified, perceived, and evaluated the impacts of the barriers. Finally, in the fourth section, the interviewees were asked about the required actions to overcome these barriers and the expected outcomes of these actions. As the interview stage proceeded, the interview questions were slightly refined, especially regarding actions, and tailored more to the two groups: organizations transitioning toward CE and organizations supporting this transition. However, flexibility was ensured, and informants were always able to bring up new topics and perspectives.

3.3. Data analysis and theorization

A grounded theory approach, combined with cognitive mapping focused on the research participants' cognitions and interpretations of key issues, was used for the data analysis (Gehman et al., 2018). Cognitive maps represent a person's causal belief system about a problem or issue. In other words, they provide an overview of an individual's mental landscape (Christopoulos et al., 2017; Furnari, 2015; Scherp, 2013). Through nodes and arrows outlining (causal) relationships or links between concepts, cognitive mapping structures problems and issues and their potential solutions into visual displays (Bagozzi et al., 2009; Eden, 2004). Cognitive maps are usually characterized by a hierarchical structure. Similar to other scholars, in developing the (visual) individual and collective cognitive maps, we located expected outcomes at the top, strategic directions and enabling actions in the middle, and barriers at the bottom of the maps (Eden, 2004; Wang et al., 2019).

In the first phase of our analysis, one researcher (first author) coded the data (Corbin and Strauss, 2015) and created cognitive maps of the individual change agents based on multiple rounds of listening to the interview recordings to ensure their accuracy (see Appendix 2 for an example). Through the iterative process of listening and note-taking, a comprehensive table of 302 concise statements was built. These statements were then coded according to barriers, enabling actions, and outcomes (i.e., sets of initial concepts) (Corbin and Strauss, 2015; Gehman et al., 2018). This table of key statements presented the interviews' details in an analyzable written format, and the audio recordings provided emotional content, such as intonation and doubts, and were used as a key data source in creating the cognitive maps (Tessier, 2012).

In the second phase, three researchers collaborated to refine the concepts and themes (Corbin and Strauss, 2015), as well as to merge the individual cognitive maps into a collective cognitive map. This merging process followed three rules: (1) overlapping concepts were combined and integrated, (2) new connections were established between concepts to capture synergies and causal relationships, and (3) the hierarchical structure of links in the individual maps was maintained (Wang et al., 2019). Based on the structural properties of hierarchies and linkages, two cluster types were determined and evaluated within the consolidated cognitive map. *Islands of themes* were clusters of nodes and arrows that were somewhat disconnected from the rest of the map (in extreme cases, only one connection). These themes indicated relatively separable issues of the main topic that could be described and addressed in isolation from other aspects. *Networks of themes* were single nodes that were supported by other nodes located at a lower hierarchical layer. These themes indicated central issues of the main topic that were descriptive or representative of different sub-aspects of the whole issue (Eden, 2004, p. 679–680). We then grouped the nodes according to their content. Importantly, our analysis of the synthesized cognitive map revealed four common cognitive frames (i.e., the most plausible schemes

Table 2
Trustworthiness and applicability of study.

Trustworthiness and applicability criteria Description of criteria	Means of ensuring criteria in this study
Validity Whether the constructs are truthful and represent precisely the aspects of the phenomenon to which they are intended and whether there is a relationship between the constructs	• The study context was carefully chosen and suitable for studying CE to ensure that the data and constructs can capture the phenomenon of interest. • An initial literature review was conducted prior to data collection. • A large number of research participants from suitable organizations were interviewed to ensure sampling adequacy and theoretical saturation. • The constructs were carefully developed and refined by multiple researchers as part of developing individual and collective cognitive maps. • The relationships among the constructs were carefully examined during the data analysis and theory development, and the theoretical framework was refined several times by the research team. • A chain of evidence can be traced from the questions of the study to the data and the main theoretical contributions.
Reliability Whether the data are adequately and consistently collected and reported, and whether the procedures can be replicated	• All interviews were conducted by the same investigator (first author), guided by pre-specified sampling criteria and an interview protocol. • Sampling adequacy and theoretical sampling were ensured by including diverse viewpoints. • All interviews were coded by the same investigator (first author), closely following relevant methodological guidelines, while other investigators helped refine the constructs. • Analysis procedures are clearly described, and the results of the analyses (e.g., individual cognitive maps) are stored in the research database. • Further details on the analyses and an example of an individual cognitive map are provided in the appendix. • The main contributions were assessed to provide a plausible theoretical explanation of the data/phenomenon.
Generality Whether the findings can be generalized to other groups and settings	• Sampling of organizations and expert informants was guided by theoretical sampling criteria. • A large number of research participants representing different industries were included. • The main theoretical contribution synthesizes the perspectives of a broad range of participants and enables generalization to other domains. • A semi-structured interview format and sufficient interview length ensured that informants could mention new themes. • Previous research and theoretical insights were integrated into the theoretical model.
Fit Whether the collected data match the core phenomenon of interest	• A large number of interviews were conducted. • The investigators were sensitive and responsive to the informants and the data. • The final theoretical contribution was evaluated by the research team and determined to provide a plausible explanation of the core phenomenon.
Understanding Whether the findings and theory can be easily understood	• Constructs were carefully developed and refined to allow understanding. • Example quotes were used to illustrate and support the developed constructs. • The constructs were complemented with further descriptions.
Control Whether findings and theory can be used to influence practice/policy	• The results and final theoretical model can be used to influence practice and policymaking.

retained by the change agents) highlighting relevant enabling actions: material choice, circular design, circular business models, and SC cooperation.

During the theory development process, we repeatedly returned to the existing literature and theory (Gehman et al., 2018; Quarshie and Leuschner, 2020). Insights on sensemaking and retention by individuals (e.g., Cristofaro, 2022; Weick, 1995; Weick et al., 2005) were especially relevant to our emerging theory, and they were integrated into our theorization effort. Specifically, the four cognitive frames (or the most plausible schemes held by change agents) derived from our empirical data were used as the basis for our final theoretical framework (Fig. 3). The framework proposes that sensemaking functions as an underlying mechanism that contributes to shifts in cognitive frames, which include different sets of enabling actions to overcome the encountered barriers and reach the desired outcomes. We refined the framework until it provided a plausible explanation of the core phenomenon of interest (Corbin and Strauss, 2015; Gehman et al., 2018). The study findings and contributions were also evaluated against common study trustworthiness and grounded theory applicability criteria (Table 2) (Corbin and Strauss, 2015; Pratt et al., 2020).

4. Results

The transition from today's linear 'take-make-dispose' SCs toward an economy organized around circularity is concurrently ambiguous and inevitable. There is a broad understanding among the 19 CE change agents that the linear economy is not a sustainable solution in the long run. How CE barriers are specifically perceived and overcome is illustrated in the strategic map (Fig. 2), which is a synthesis of the individual maps that emerged from the interviews with the 19 change agents operating in the context of CE transitions within the Swiss economy. Moreover, in the strategic map, we identified four main cognitive frames (i.e., plausible schemes), which illustrate shared perceptions of core barriers, actions, and outcomes retained as a result of sensemaking by (some of) the change makers. The frames are somewhat overlapping yet complementary, and each informant can rely on one or more of these frames.

Specifically, the strategic map is a consolidation of the individual maps, all of which follow the same structure with three levels: outcomes at the top, enabling actions in the middle, and barriers at the bottom. In the middle, four strategic directions mark the top of four cognitive frames. Enablers reaching the strategic directions are direct enabling actions (underlined), while enablers that have multiple arrows reaching and exiting are key enabling actions (in bold). All three levels of the strategic map are elaborated on in this section. The circular SC barriers are briefly outlined in Section 4.1. We then conceptualize in greater detail the strategic directions and direct and key enabling actions for each cognitive frame in Section 4.2 and the circular SC outcomes in Section 4.3.

Table 3
CE change agents' quotes on strategic directions.

Strategic direction	Change agent quote
SC cooperation	D: "Only a network of companies can close the loop; for individual companies, this is practically impossible." K: "(…) it is rarely possible to implement CE as an isolated solution." J: "Building up a reverse supply chain is only possible by including all supply chain participants." M: "It is a systemic problem that a company cannot solve alone."
Circular business models	C: "Not only because of the initial investment but also to find a way to keep the existing business, which is making money and slowly switch to a new business model." D: "You actually have to convert your entire company." K: "Also regarding the existing business model, the risk is rather against innovations in terms of CE. (…) For most companies, the change to which form of CE is still a risk. The established business model is simply easier and easier to assess."
Circular design	D: "If you want to close the loop sensibly, you actually always come back to design." G: "On the one hand, we try to design a product in such a way that it can be adapted to changing conditions—some of which we do not even know about today— and on the other hand, we try to make it of such high quality that it can be in use for an extremely long time, if not forever, so that it almost never has to be recycled."
Material choice	J: "Material comes first. In the past, it did not matter which components a product contained. The focus was on design and marketability. Now we first look at which materials can be circulated best and most easily." Q: "Material choice involves questions such as how easy it is to disassemble and assemble products, how to use not too many materials or how easy it is to separate materials (…)." B: "In the past, we didn't have the materials: No alternatives for plastics, no alternatives for colors and so on. We have that today—now we can start."

4.1. Circular supply chain barriers

The bottom of the strategic map illustrates the perceived barriers that originate from different areas of the circular SC (Fig. 2). One barrier that seems particularly ambiguous and disorienting among the CE change agents is the predominant linear thinking along SCs. This manifests itself in various functional areas in organizations, ranging from procurement and contract management to accounting and marketing. For example, one of the CE change agents explained that many circular business models tend to perform worse because their businesses are still evaluated according to linear paradigms. As circular business models often have different cash flow and cost structures, the challenges of companies evolving today's linear evaluation methods toward circularity are enormous. Linear thinking is also the reason for the lack of financial solutions supporting the transformation to circular products or business models. Similarly, financial incentives are often not strong enough to switch from primary to secondary materials. Moreover, some change agents mentioned rigid company structures as obstacles to circular transition. These structures promote silo mentalities and linear decision-making processes, preventing necessary cross-functional and cross-company collaborations. According to one CE change agent, functional silo thinking occurs very quickly at companies of a certain size because many of today's management systems structurally promote this. Here, we again see how linear thinking and the measurement of team performance present a challenge to overcome. It was pointed out that procurement departments, which have a crucial role in the circular transition, especially need to overcome their silo mentality. Besides those organizational and cultural barriers, the strategic map of interviewees also reveals barriers related to technological aspects. Specifically, material choices and the composition of products are noteworthy. One CE change agent remarked that non-organic materials are better explored in terms of their quality and durability than organic materials. Naturally, this causes risk aversity against new materials. Paired with the usage of chemicals and mixed materials, uncertainty regarding new materials and procedures leads to unsatisfying recovery processes and a preference for virgin materials. Therefore, it was argued that only healthy and separable materials should circulate, while problematic materials should be excluded. Another significant barrier is linked to predominantly linear SCs. The transparency of material, information, and financial flows often stops abruptly at the point of sales, hampering circularity aspects such as asset optimization through maintenance and repair, take-back programs, and recycling. It was also mentioned that managers fail to consider the return of products and their tracking during the use phase. Lacking transparency, reverse infrastructure, and bargaining power in SCs significantly hamper the circular transformation of many companies. One CE change agent reported that most companies are eventually confronted with the question of whether the responsibility lies with individual companies, entire industries, or society to ensure closed loops. This is an important question that needs to be answered to overcome these barriers.

4.2. Circular supply chain enabling actions

4.2.1. Cognitive frame a – supply chain cooperation

Cognitive Frame A encompasses enabling actions related to the topic of strategic direction, ***SC cooperation*** (see the red frame in Fig. 2 and Table 3). Most interviewees considered cooperation with other companies central to the circular transition because circular SCs demand more interorganizational collaboration than the current linear SCs. The importance of collaborations was especially emphasized for overcoming the lack of reverse SCs. The success of collaborations appears to depend on the commitment, trust, and open communication of all parties involved in the SC.

These requirements are also reflected in the cognitive frames' direct and key enabling actions, which aim to establish the prerequisites for fruitful cooperation. The only critical key enabling action belonging to this cognitive frame is *increasing the visibility of material, information, and financial flows* (Table 4). The visibility within the circular SC ecosystem was considered to be an important prerequisite for the traceability and measurability of relevant aspects of circular SCs. Regarding the circular transition, traceability and measurability were highlighted as crucial for enhancing the long-term decision-making of companies and entire SCs. Moreover, increased visibility of the material, information, and financial flows within circular SC ecosystems facilitates business model innovations by improving knowledge regarding materials and processes.

Starting with the first direct enabling action of *searching for suitable partners*, the importance of building collaborations with like-minded actors to start the circular transition was emphasized (Table 5). The change agents noted that companies could improve their long-term competitive advantages by proactively engaging in the search for suitable partners (including suppliers and customers). Due to their lack of power and influence over the SC, smaller companies might benefit from bundling resources and capabilities with other organizations within the circular SC.

The second direct enabling action is *strengthening active communication* (Table 5). Active communication contributes to transforming the linear thinking of partners in SCs. For instance, the CE change agents highlighted the importance of working on solutions together with suppliers rather than imposing solutions on them. In this process, active communication is vital to convince suppliers to engage in new forms of circular-oriented collaboration.

The last direct enabling action of this cognitive frame is *building trust*

Table 4
CE change agents quotes on key enabling actions.

Key enabling action	Cognitive frame				Change agent quote
	A	B	C	D	
Increasing the visibility of material, information, and financial flows	x			x	B: "As long as sustainability and above all CE is not measured or cannot be measured, it is difficult to argue for it." K: "The topic of material tracing is a big one too: You should know where, when, which material is on its way as well as when and in what condition it will come back."
Working toward top management support for change		x	x		M: "The moment top management is involved, it works." O: "CE comes very much from above and is anchored in our strategy and vision." J: "CE follows a top-down approach and is clearly at the top of the agenda in the top management."
Developing business model innovations		x	x		R: "Often companies do not proceed innovatively enough but want to make the existing business model circular." L: "It is always a risk to try out new circular business models, simply because you are often the first to do it."
Building up knowledge about material and product cycles			x	x	L: "One person looks at this part of the process, someone else looks at another and no one looks at processes as a whole." A: "People have to learn to think in cycles." R: "Even companies that are well informed are often not aware of what exactly needs to be changed to make a product or business model circular."
Considering the entire life cycle				x	S: "Taking a supply chain perspective is still exotic and unknown to many companies, because the responsibility in the linear system always ends when you have sold your product." Q: "You always have to keep the whole cycle in mind and then apply your core skills in the right place in that cycle."

within SCs (Table 5). Interorganizational trust is essential because necessary visibility over the SC can hardly be achieved without it. Trust comes into play when visibility reaches its limits, especially when facing uncertainty. While standards and certifications can enhance trust by acting as unilateral safeguards and traders of knowledge for buying companies, inter-organizational trust can also be built through long-term relationships in SCs.

4.2.2. *Cognitive frame B – circular business models*

Cognitive Frame B covers enabling actions for establishing ***circular business models*** (see the blue frame in Fig. 2 and Table 3). According to many CE change agents, the current linear system and managerial thinking are significant barriers to the circular transition of organizations and entire markets. Transitioning toward a circular business model without cannibalizing the current linear business model is one of the biggest challenges for well-established companies during their transition. Not only individual organizations but also entire SCs are asked to align their business models with CE principles. The key and direct enabling actions belonging to this cognitive frame aim to drive business model transformation.

Working toward top management support *for change* is the first key enabling action in Cognitive Frame B (Table 4). Nearly all change agents noted the importance of top management support, which is essential for successfully overturning existing linear business models within SCs. For

Table 5
CE change agents quotes on direct enabling actions.

Direct enabling action	Cognitive frame				Change agent quote
	A	B	C	D	
Searching for suitable partners	x				C: "You talk to suppliers who are willing to go on a journey with you, then cooperation develops. (…) If you have one or two successful examples, the journey usually really starts." E: "I have contacted over 80 plastic processing companies to find my current partner."
Strengthening active communication	x				J: "Communication is very important; you have to fetch the supplier where he is and work out solutions together."
Building trust within SCs	x				A: "(…) one must succeed in demonstrating the sense of collaboration in the supply chain." G: "Ultimately, it is the work with the partners over decades that builds trust and enables improvements to be made in many small steps."
Changing the corporate culture		x			D: "Ultimately, accepting a change to a CE is also a question of corporate culture." N: "A big issue is to let go of the old and do the new. This change is not easy to implement (…). You need to be willing to think about this transformation." H: "The human factor is as it is, that is, it is difficult to change. The most important thing is to integrate and coach."
Gaining experience through experimentation		x	x		I: "You must start pragmatically with trial and error. The mindset must be right, and then you always get ahead. There will always be new solutions but also failures." O:" In this innovation and design processes, you simply must try things out." M: "Simply launch into something, try and error, without claiming to know how to do it. But at least tackle, find out, and see what works."
Establishing a long-term strategic orientation	x	x			P: "It needs people who have a long-term vision and who are willing to take risks and break new ground."
Working toward material and product innovations			x	x	Q: "We all love to try new things and turn them into a business. That is also something very satisfying: turning an idea into a business that generates enough cash flow to trigger the next idea." S: "Innovation doesn't even require an innovation department but rather an innovative spirit throughout the company, including the employee at the machine."
Utilizing SC innovators				x	E: "My supplier has been trying out the latest biological plastics for 20 years and therefore knows a lot."
Establishing quality control				x	N: "If we take back foreign materials, quality assurance comes into play." G: "Serving a second-hand market is a new business area, but we take care to maintain quality so that we only work with selected partners." K: "Transparency is crucial again because you have to know who the product is from to be able to assess its quality."
Using mono material				x	E: "Mono material is best of course because it allows 1:1 recycling without adding any new raw material, which is rarely possible with plastics." J: "The changeover to the mono material polyamide 6 was a long process, which required a lot of development work."

instance, boards of directors can anchor circular strategies and visions in organizations. Regarding their organizations, the CE change agents noted that precise top-down approaches are necessary to transition toward circular business models. Although circular initiatives often emerge from middle management, top management support is needed to evolve into clear actions.

Developing business model innovations is the other key enabling action in this cognitive frame (Table 4). Companies exhibit a disconnect between their innovativeness and their desire to make the existing business model circular. However, incremental organizational changes are usually insufficient to align the business model with CE demands. Therefore, many interviewees emphasized that changing the current business model or creating new business models is fundamental for ensuring long-term organizational success.

Considering direct enabling actions, *changing the corporate culture* directly affects the willingness of employees and managers to overturn the existing linear business model (Table 5). Since circular transformation requires drastic changes that affect employees and their work, it is important to simultaneously change the corporate culture in organizations. The enabling action of education and training of employees were mentioned as specific strategies for fostering the necessary change in corporate cultures.

Another direct enabling action is *gaining experience through experimentation* (Table 5). Several change agents noted the importance of pilot projects for achieving experience within the transition toward a circular business model, especially when companies transition from a product-based to a service-based business model. The establishment of a circular business model requires some pragmatism because trial-and-error approaches are needed to determine the trajectories of organizational development and change.

The third and final direct enabling action of this cognitive frame is *establishing a long-term strategic orientation* (Table 5). Contrary to today's corporate structures and cultures, which are often characterized by a short-term orientation, a long-term approach is required for employee objectives, decision-making processes, key figures, and success measurements. The change agents reported that a long-term strategic orientation can be particularly often found in family-owned companies. They noted that some family-owned companies established CE aspects in their business models years ago, which are now paying off financially.

4.2.3. Cognitive frame C – circular design

Cognitive Frame C contains enabling actions related to the development of ***circular designs*** (see the green frame in Fig. 2 and Table 3). Product design is essential for ensuring the longevity of products and material circularity. However, various aspects need to be considered when aiming for circular products. While aspects such as purpose adaptability over time and quality influence the extent of the use phase, material separability and decomposability affect the end-of-life phase of products.

The first key enabling action is *working toward top management support for change* (Table 4). Numerous CE change agents considered top management support essential for the design and development of circular products. Top management support is especially important in situations when design initiatives emerge from middle management, which often promotes only incremental innovations instead of disruptive ones because of a lack of leadership support and decision-making authority for high investments or process changes. Top-down approaches can eliminate such blockages of product design innovations.

Moreover, *building up knowledge about material and product cycles* represents another key enabling action to develop circular product designs (Table 4). The interviewees noted that there is often an untapped potential for improvement because many managers only look at isolated processes and try to implement aspects of circularity without considering the entire life cycle. Even well-informed companies find it challenging to adopt more holistic views of the cycle during the product design phase. The change agents noted that companies should enhance their understanding of the product and material cycles to improve their product designs and rethink linear processes.

Finally, *developing business model innovations* is the last key enabling action, depending on the previously outlined key enabling actions of this cognitive frame (Table 4). Since product development is strongly tied to the organizational business model, business model innovations and design process adaptations must be adjusted simultaneously. Some change agents pointed out that innovations ultimately turn new products and processes into successful business models.

The first of the two direct enabling actions in Cognitive Frame C is *working toward material and product innovations* (Table 5). The development of circular products requires an organizational mindset to innovate. Specifically, one CE change agent explained that material and product innovations require an innovative spirit throughout the firm rather than having one team or department solely focusing on innovations. However, the development of innovative prototypes requires disruptive thinking, which might be a challenge for some designers and their organizations. In addition, the interviewees emphasized that staying power is essential when product innovation takes place because the development process often requires the long-term involvement of all partners in the SC.

Gaining experience through experimentation is the other direct enabling action in this cognitive frame (Table 5). Change agents considered piloting as the best way to build up knowledge and determine possibilities for circular product designs. Instead of working on incremental innovations, one informant mentioned that companies should tackle novel issues using a trial-and-error approach to see what works. Companies need to not only overcome their risk aversion against new experiments but also cope with the ambiguity and uncertainty related to new products and materials.

4.2.4. Cognitive frame D – material choice

Cognitive Frame D includes enabling actions concerning ***material choice*** (see the yellow frame in Fig. 2 and Table 3). Material selection is fundamental for circular transition because it determines, among other aspects, the recyclability and disposability of products. Materials should be the first thing to consider when aiming for more circularity. Material selection is closely related to design choices, including the separation of materials, number of used materials, or multipurpose products. Besides material circularity, material health is another vital aspect of material selection. For example, using 'inappropriate' or toxic materials contaminates the biological and technical aspects of the circular SC and thereby undermines the broader ambition for more circularity.

The first key enabling action belonging to Cognitive Frame D is *considering the whole product life cycle* (Table 4). Since material lays the basis for circularity, companies need to consider the entire life cycle of materials used for their products or services. Too often, material decisions are made based on an SC understanding that ends at the point of sale. This is especially problematic in industries with long product life cycles, where considerations such as reuse, repurposing, or recycling are decades away from the point of production. However, product life cycle thinking does not mean the loss of core competencies but rather a specialization of companies along the SC under consideration of the entire product life cycle.

Another key enabling action for enhancing the use of circular materials is *increasing the visibility of material, information, and financial flows* (Table 4). Visibility is considered a key prerequisite for material circularity. For example, material tracing generates knowledge about the location, status, and use of materials and their composition and, as such, facilitates circularity. In this context, the ownership of materials during the product life cycle needs to be clarified.

The final key enabling action in Cognitive Frame D is *building up knowledge about materials and product cycles* (Table 4). This allows companies to improve the selection and coordination of materials along the SC. However, gaining knowledge is time-consuming and costly, so progress only happens in small steps. The support of certifications can

help with this process. Overall, the CE change agents noted that knowledge is best built up through cooperation across the entire SC.

The first direct enabling action outlined is *working toward material and product innovations* (Table 5). Material selection improves the circularity of products. To have the option of using circulatable and healthy materials in their products, companies are often asked to engage in material and product innovations. This, however, brings along external dependencies, leading to difficulties and uncertainties. Therefore, a supra-organizational mindset is crucial when aiming for material and product innovations.

The second direct enabling action contributing to the use of more circulatable and healthier materials is *utilizing SC innovators* (Table 5). In addition to working on the development of innovations themselves, material and process innovations can also be realized with the help of SC partners. For example, one of the CE change agents referred to an organization that managed to transition toward biological plastics with the help of its innovative supplier. The supplier is now profiting from increased visibility and attractiveness through the collaboration. Moreover, change agents noted that bigger companies can facilitate material testing in collaboration with innovative start-ups.

Another direct enabling action in Cognitive Frame D is *establishing quality control*, which is crucial for assessing the quality of external materials (Table 5). Although both the primary and secondary markets can be used for sourcing materials, secondary (repurposed) materials especially demand new quality control mechanisms. This is highly reliant on the transparency in the SC to ensure the quality of materials.

Moreover, *using mono material* is a direct enabling action (Table 5). The use of mono materials is beneficial to achieve circularity because of their considerably better recyclability. Additionally, mono materials allow better scrutiny of material health and reverse SCs. However, the transition to mono materials can also be challenging because they often lack the qualities and features desired by many companies.

4.3. Circular supply chain outcomes

The goal statements at the top of the strategic map can be divided into expected circular SC outcomes and short-term goals for those ultimate purposes. The outcomes are across the top, while short-term goals are situated above the four strategic directions. Short-term goals would be akin to what some managers would call 'low-hanging fruits'. The four ultimate outcomes identified are *minimized waste and pollution*, *less resource consumption*, *increased SC viability*, and *a lower total amount of capital investment*. Whereas the barriers and enabling actions in the individual cognitive maps varied among the CE change agents, the outcomes exhibited a high level of unity. This indicates an advanced stage in the sensemaking process, although discussions about a shared understanding of the middle and lower sections are only starting to gain momentum. One change agent summarized the overarching goal as maximizing the value an organization gets from resources by consuming as little as possible and using products and materials as long as possible. Generally, a string of goals must be achieved to reach the ultimate outcomes. For example, higher quality and improved modularity of products enable the increased longevity of those very products, elevate their circularity, and ultimately minimize waste and resource consumption.

Another change agent explained that his company has started to internalize long-term thinking, which not only manifests in the quality and modularity of their products but also in employee thinking and establishing strategic partnerships. Similarly, the outcomes of new business models enable unique selling propositions and extend cost savings, which in turn create added value and ultimately increase SC viability. For example, one of the change agents referred to a manufacturing company building high-quality beds that could only financially profit from its circular transition by changing its business model. Rather than selling products, the manufacturer charges its customers per usage, creating new selling propositions that include different revenue and cost structures.

Another string of goals results in the ultimate outcome of improved SC viability. One of the CE change agents mentioned that common standards emerged in the network of an organization after establishing more collaborations with other SC partners. In addition, the incentive systems changed collaboration for the better, resulting in industry solutions and increased SC viability upon which the network can build. Although financial benefits are not yet apparent, individual companies are willing to invest in circularity because of the shared vision and goals among SC partners. Specifically, an overall goal with regard to materials is independence from the primary material market. This leads to stronger secondary markets, elevating the circularity of materials, and ultimately the minimization of waste and resource consumption. Apart from political intervention, the secondary material market can be strengthened through SC collaborations. Another crucial goal is enhanced material health, which contributes to the ultimate goal of minimizing waste and pollution. One of the change agents explained that material health is essential for minimizing waste because toxic substances, such as the catalyst antimony in polyethylene terephthalate bottles, heavily constrain circular practices.

5. Theoretical CE sensemaking framework

In advancing circular transitions, change agents are in a continuous process of seeking, interpreting, and responding to information from their surrounding environment (Weick, 1995). To interpret and make sense of complex and ambiguous signals, individuals construct and rely on cognitive frames that not only help organize information but also support the development of appropriate strategies (Hahn et al., 2014). We integrated the empirical results and the strategic map (Fig. 2) developed based on them, as well as insights from the theoretical lens presented previously (Corbin and Strauss, 2015), to develop a theoretical framework that illustrates the relationship between the adoption of cognitive frames and the sensemaking of individual change agents in response to information and feedback from their surrounding environments (Fig. 3).

The framework puts forward four alternative, yet complementary and partially overlapping, cognitive frames (e.g., the most plausible schemes) for pursing the transition toward circularity in SC contexts: *material choice*, *circular design*, *circular business models*, and *SC cooperation*. The four cognitive frames in Fig. 3 correspond to the frames identified in our research, which were derived by analyzing and synthesizing the cognitive maps of individual change agents. Sensemaking functions as an underlying mechanism that contributes to and helps to calibrate the cognitive frame(s) and strategies of individual change agents. The (initial) enactment, selection, and retention of a change agent's cognitive frame(s) may be influenced by personal (e.g., position, sphere of influence, and motivation) and organizational characteristics (e.g., sector) but can also be altered by the iterative interaction with the surrounding context and emerging events (Chia, 2000). Based on the perceived barriers, individuals may adjust their respective cognitive frames and the transition strategies they pursue in the hope of achieving their desired short-term goals and ultimate SC outcomes (e.g., *minimized waste and pollution*, *less resource consumption*, *increased SC viability*, and *a lower total amount of capital investment)*.

Pursuing a holistic circular SC strategy is likely to require the adoption of multiple, if not all four cognitive frames, which vary in their scope of implementation. Each frame represents a particular set of enabling actions that can be used individually or in combination for the circular SC transition. Individual change agents may not only pursue actions that belong to different sets of enabling actions but may also adopt multiple cognitive frames. As certain enabling actions belong to more than one set of actions, overlaps of neighboring cognitive frames can be found, for example, between *material choice* or *circular design*, where the enabling action of *working toward material and product innovations* overlaps (Fig. 2). These overlaps may facilitate changes in

cognitive frames, contributing to either frame switching or the addition of a complementary frame, as indicated by the arrows labeled A (Fig. 3). For example, after recognizing the limits of certain actions to achieve desired short-term goals, such as improving the company's sales position, change agents adopting a *circular business model* frame may move away from pure product sales toward more service-oriented offerings, leading them to embrace enabling actions in the realm of *SC cooperation*. Offering more services might require searching for new partners and ensuring greater SC traceability. The two arrows that are labeled B (Fig. 3), moving from barriers through enabling actions to outcomes, illustrate the transition strategies by the change agents. They develop premises, expectations, and an understanding of the circular transition and their larger context, influencing their enabling actions. The three curved arrows, labeled C (Fig. 3), symbolize sensemaking, or the potential calibration of cognitive frames and actions relative to the perceived barriers and outcomes. When desired short-term goals are not achieved, individuals may encounter or become aware of new barriers to the circular transition, leading to a calibration of cognitive frames and strategies (C1). Failure to achieve ultimate outcomes has a similar effect. Change agents may perceive or proactively seek out new barriers, which may also lead to an adjustment of cognitive frames and related sets of actions (C2). Moreover, the pursuit or realization of ultimate outcomes may directly trigger the adoption of new cognitive frames and strategies, without new barriers being identified (C3). This iterative process of action and interpretation is essential for navigating the complex and uncertain transition toward circularity (Quarshie et al., 2021; Waddock, 2019).

6. Discussion

The 19 individual cognitive maps of the CE change agents are snapshots of their mental models and provide insights into their understanding of the barriers, enabling actions, and outcomes of the circular SC transition. Based on the change agents' interpretations of the core phenomenon of interest, the study identified four cognitive frames—SC cooperation, circular business models, circular design, and material choice—that are relevant for the holistic circular transition of SCs. Each cognitive frame corresponds with a set of enabling actions that contributes to circularity.

6.1. Theoretical contributions

Our paper makes several theoretical contributions. First, it advances our theoretical understanding of CE and circular SCs through the development of a strategic map and a theoretical framework. While prior research has focused largely on identifying and grouping barriers to and enablers of the circular transition (e.g., Govindan and Hasanagic, 2018; Vermunt et al., 2019), our study goes beyond that to offer a theoretical explanation of how the perceived barriers (and sought outcomes) may contribute to the adoption of cognitive frames and related actions and strategies (see Fig. 2). We theorize that when confronted with certain barriers found within their surrounding environments, change agents may adjust their adopted cognitive frames either by shifting or extending previous beliefs and expectations with new cognitive frames (see Fig. 3). Thus, our study differs from many previous studies that have tended to look at barriers and strategies in isolation (Hina et al., 2022; de Jesus and Mendonça, 2018). Moreover, our research adds to the literature exploring the sensemaking of the CE and the transition toward it (e.g., Blomsma and Brennan, 2017; Kuhlmann et al., 2023).

Besides contributing to CE and circular SC theory, our study also falls under the broad sustainable purchasing and SCM domain (Pagell and Shevchenko, 2014; Quarshie et al., 2016), and specifically joins discussions on circular SCs (e.g., Batista et al., 2018; Tate et al., 2019). Although individuals are responsible for driving sustainability in companies and along SCs, the literature has tended to neglect the perspectives of change agents by focusing predominately on organizations and SCs as units of analysis (e.g., Hussain and Malik, 2020). We add to this broader circular SC conversation by providing insights into change agents' sensemaking of circular SC transitions (see also Kuhlmann et al., 2023). Specifically, we present a collective cognitive map (see Fig. 2) that points to four cognitive frames for translating the circular SC transition and related strategies. Moreover, we provide a framework (see Fig. 3) that illustrates how sensemaking functions as an underlying mechanism that affects the cognitive frames of change agents and their pursued strategies. Many managers, as change agents, have a major influence on the formulation of circular strategies (Raes et al., 2011; Koistinen et al., 2022). Gaining insights into their perceptions not only enhances our understanding of how a circular transition is translated and pursued but may also contribute to the identification and development of best practices for circular SC management.

Third, we make a contextual contribution by focusing on Switzerland, where circular transformation processes have not yet been thoroughly examined (Stucki and Wörter, 2022). The Swiss context is particularly interesting because Swiss companies and their SCs are largely dependent on imports due to Switzerland's limited natural resources. In addition, many Swiss companies' wait-and-see attitude puts the country's overall competitiveness at risk, as many resources become scarcer because of increases in demand (Stucki and Wörter, 2022). Our study indicates how change agents understand the circular transition of SCs—a reduced resource dependency in the context of developed countries—a view that is also of interest to other European countries (European Commission, 2022). Although our results are derived from contextual knowledge and interpretation of a certain group of individuals in Switzerland (Schwartz-Shea and Yanow, 2012), other scholars can explore other country-specific or cross-country studies on this topic.

6.2. Practical contributions

The findings of this study also have implications for individual managers and companies. For managers, our research not only highlights specific actions in the area of the circular SC transition but also synthesizes them into strategic sets of enabling actions that are related to four cognitive frames (i.e., plausible schemes). Realizing circularity in SCs requires holistic thinking and the implementation of actions from one or more of the enabling actions found in the cognitive frames. The key practical takeaways of this study for managers relate to four (alternative yet complementary) strategies: *material choice*, *circular design*, *circular business models*, and *SC cooperation*. Managers are provided with starting points on how circular actions in individual business areas affect other areas. This is of particular importance, as the success of circular SC implementation heavily depends on the ability of top managers to secure business profitability during the transition (Koistinen et al., 2022). If the goals, strategies, plans, and resources of all business units are aligned, the probability of success of a CE transition increases, especially because fundamental changes, such as the shift to circular business models or the opening of new SC partnerships, must also be addressed.

Companies could rely on one or more of these strategies as their launch points to formulate a strategy for the circular SC transition. Here, the four strategies can help position the organization and evaluate the next development steps. In this context, the practical contributions of this study also include the identification of a large number of enabling actions that can function as orientation aids and starting points, especially for organizations in the early CE transition stages. Typically, organizations start actions toward circularity in areas of the SC that are closest to the existing linear business model, often emerging from departmental or people-specific initiatives, which then remain incremental and limited to the operational level because they neglect the required holistic approach (Prendeville et al., 2016). Further, organizations, even those that are more advanced, can identify blind spots in

their CE transition measures by consulting the strategic map.

7. Conclusion

In this study, we adopted a qualitative research approach to examine how CE change agents make sense of and respond to the complexity of the circular SC transition. A strategic map was developed to synthesize and outline the perceptions observed across the data collected from a sample of Swiss managers involved in the circular SC transition. Building on this map, we developed a theoretical framework (see Fig. 3) that outlines how sensemaking affects the adoption of cognitive frames and the set of actions for transitioning toward circular SCs. Four cognitive frames were revealed: *material choice*, *circular design*, *circular business models*, and *SC cooperation*. These frames guide related strategies for overcoming CE barriers and achieving desired CE outcomes.

As with all studies, our research has limitations. Our study was conducted in a limited number of sectors in the context of Switzerland. Although our findings can inform CE research and practice in other countries, the single-country setting can limit the generalizability of our results. Moreover, our research uses an interpretive qualitative approach to develop a theoretical framework—that is, a plausible explanation of the phenomenon of interest (Corbin and Strauss, 2015; Pratt et al., 2020). As such, there is a need for further studies to extend and test our findings. For example, in-depth case studies can be carried out to examine the varying perceptions of different types of stakeholders. Greater focus could also be on the hitherto scarcely researched field of inter-personal CE sensemaking at the inter-organizational level (e.g., see Kuhlmann et al., 2023). In addition, our study could be replicated in other countries and sectors to reveal further enabling actions and their outcomes. It would be interesting to see how perceptions differ in larger countries, such as the USA, China, and India. Finally, the specific links between enabling actions and outcomes must be hypothesized and tested. This will help produce a more fine-grained understanding of the relationships between the perceived barriers, enabling actions, and outcomes of circular SC transitions.

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Research involving human participants and/or animals

All procedures performed in this research were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants involved in the study. This research does not involve animals.

CRediT authorship contribution statement

Roger Nyffenegger: Conceptualization, Formal analysis, Investigation, Methodology, Validation, Writing – original draft, Writing – review & editing, Data curation. **Axel Zehendner:** Conceptualization, Formal analysis, Methodology, Validation, Writing – original draft, Writing – review & editing. **Anne M. Quarshie:** Conceptualization, Methodology, Validation, Writing – original draft, Writing – review & editing. **Rudolf Leuschner:** Conceptualization, Methodology, Validation, Writing – original draft, Writing – review & editing.

Declaration of competing interest

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

Data availability

Data will be made available on request.

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Appendix

Appendix 1. Initial interview guide

Interview guide

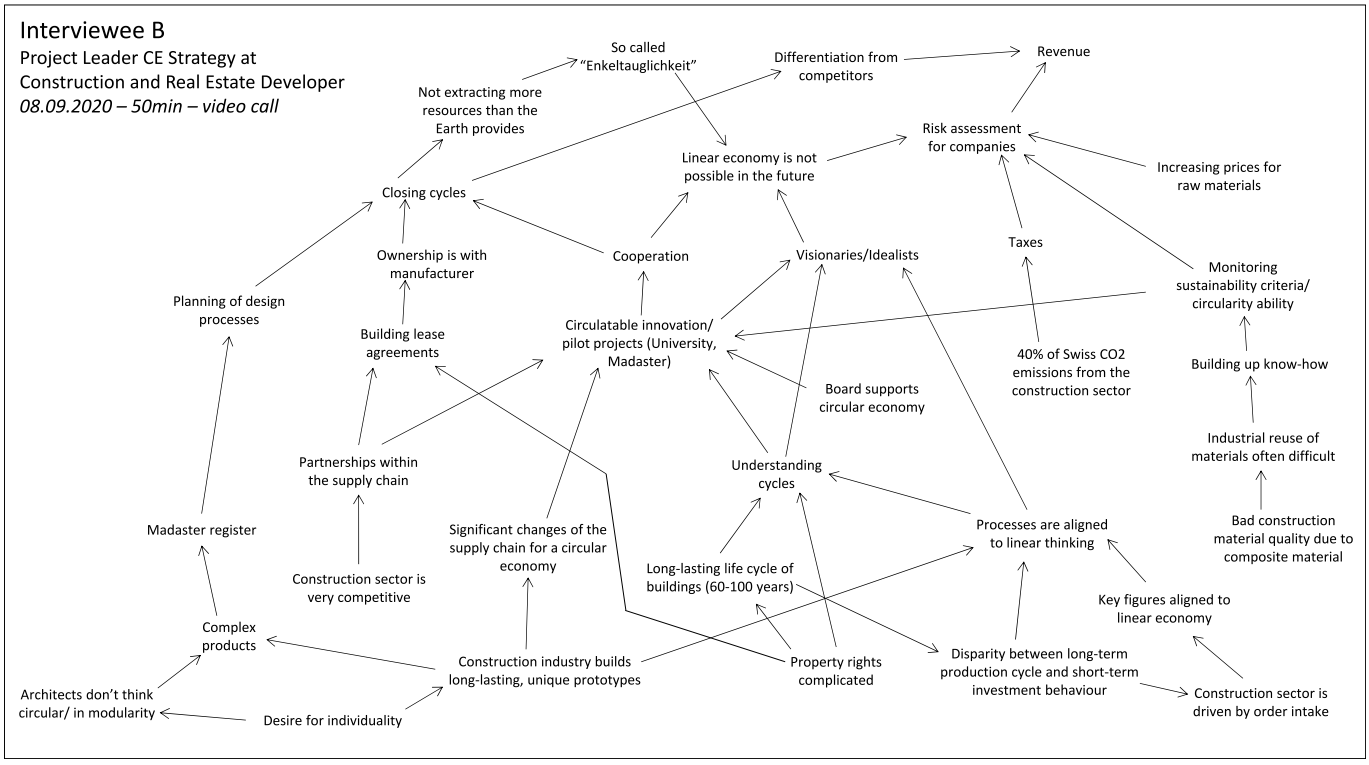
Section	Question
Greeting of the interview partner; explanation of the topic as well as the background of the interview; not on publication and possibility of anonymization	
General	1) Briefly describe the company you work for (industry, number of employees, etc.).
	2) Briefly describe your position within this company (responsibilities, hierarchy level, activities).
Circular Economy	1) How do you define CE? How does your company understand CE?
	2 Why does your company engage in CE?
CE Barriers	1) What do you consider the biggest internal company barriers that prevent the introduction of CE in companies?
	2) Do you see any barriers regarding material, product design, or production processes?
	3) Can insufficient knowledge about material composition, modularity, etc. of supplier products be a blocker for CE?
	4) Is there a sense of urgency in your company to implement CE principles?
	5) Is there a willingness to increase cooperation in the value chain?
	6) To what extent does the existing linear system influence corporate decisions regarding CE?
	7) Do risk considerations have a negative influence on decisions in the direction of CE?
	8) Does top management have CE on its radar in your organization? Does the CE find mention in the strategy, vision, or KPIs of companies?
	9) To what extent does internal department silo thinking hinder circular solutions?
	10) How many times is the non-existence of a reverse supply chain a problem?
	11) Do fluctuating quantities of returned products, product parts, or raw materials prevent circularity?
CE Enabler and outcomes	1) What facilitates/enables the promotion of the circular economy in your organization?
	2) How does it help if the company adopts a supply chain rather than a business perspective?
	3) Does more integration (between departments in the value chain) promote the circular economy?

(*continued on next page*)

(*continued*)

Interview guide	
Section	**Question**
	4) To what extent does greater visibility along the supply chain lead to the simplified introduction of CE approaches? 5) How strongly do collaborations with other companies influence the implementation of CE approaches? 6) Does increased collaboration within the company benefit the CE? 7) How can innovative technologies support CE? 8) Does increased risk awareness advance CE? 9) Does openness and readiness for innovation stimulate CE?
Thank you, farewell, open questions.	

Appendix 2. Example of an individual cognitive map (interviewee B)



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