Lessons, narratives and research directions for a sustainable circular economy

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FORUM

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Abstract

The current enthusiasm for the circular economy (CE) offers a unique opportunity to advance the impact of research on sustainability transitions. Diverse interpretations of CE by scholars, however, produce partly opposing assessments of its potential benefits, which can hinder progress. Here, we synthesize policy-relevant lessons and research directions for a sustainable CE and identify three narratives—optimist, reformist, and skeptical—that underpin the ambiguity in CE assessments. Based on 54 key CE scholars' insights, we identify three research needs: the articulation and discussion of ontologically distinct CE narratives; bridging of technical, managerial, socio-economic, environmental, and political CE perspectives; and critical assessment of opportunities and limits of CE science–policy interactions. Our findings offer practical guidance for scholars to engage reflexively with the rapid expansion of CE knowledge, identify and pursue high-impact research directions, and communicate more effectively with practitioners and policymakers.

KEYWORDS
industrial ecology, narratives, policy relevance, research agenda, science policy, sustainability

1 | INTRODUCTION

Few other sustainability-related concepts have been able to spark the imagination, enthusiasm, and commitment of academics, businesses, non-governmental organizations (NGOs), and governments worldwide as the circular economy (CE). Presenting a distinct perspective on value creation, the CE aims to enhance efficiency and sufficiency of resource use, offering a "toolbox" for innovation toward an environmentally, socially, and economically sustainable world (Lazarevic & Valve, 2017; Winans et al., 2017). Given the CE's transformative aspirations, many research efforts aim to produce policy-relevant knowledge supporting profound changes toward sustainability—which we understand as sustaining human life within a safe and just operating space (Raworth, 2017).

While reviews of existing CE research are abundant (Geissdörfer et al., 2017; Ghisellini et al., 2016; Lieder & Rashid, 2016), few condense policy-relevant knowledge (McDowall et al., 2017). More importantly, the complexity of the CE concept has produced widely diverging scholarly assessments regarding its technical, socio-economic, environmental, and regulatory potential and challenges (Singh et al., 2021). While many

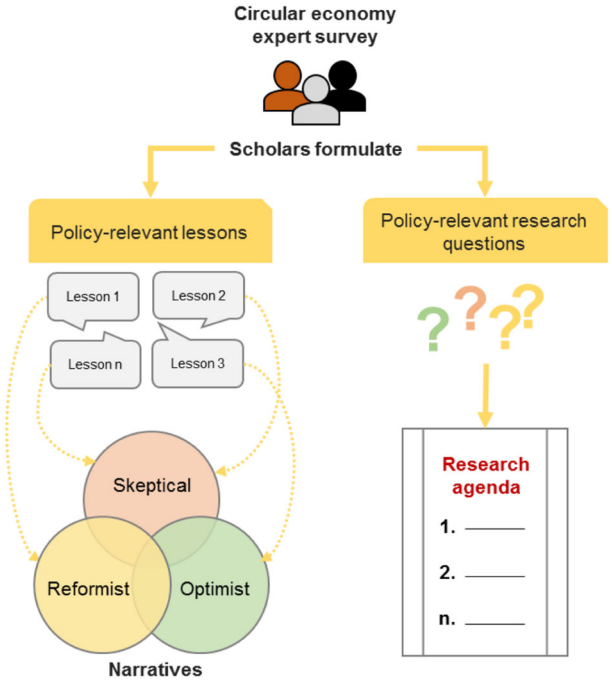

FIGURE 1 Simplified research design. Academic experts provided their main policy-relevant lessons and research questions on a sustainable circular economy. The lessons were grouped into three narratives (i.e., skeptical, reformist, and optimist), whereas the questions were refined to elaborate a research agenda

CE accounts are celebratory (Milios, 2018; Su et al., 2013), fundamental criticism on the CE's core assumptions (Skene, 2018), social benefits (Millar et al., 2019), and contribution to environmental sustainability is rising (Blum et al., 2020; De Man & Friege, 2016). In addition, comprehensive accounts of future directions for CE research are lacking. Research agendas and frameworks remain fragmented and focused on particular aspects. These include industrial activities (Bressanelli et al., 2020; de Sousa Jabbour et al., 2018), business models (Lüdeke-Freund et al., 2019; Pieroni et al., 2019), communication (Chamberlin & Boks, 2018), systematic monitoring (Corona et al., 2019; Saidani et al., 2019), and governance (Fratini et al., 2019; McDowall et al., 2017). This study argues that the CE's ambiguity, that is, allowing for several interpretations, contributes to these diverging assessments and lack of shared direction. Such ambiguity is a common feature of broad concepts like CE (Korhonen et al., 2018).

If academics are to provide policy-relevant evidence on the potential benefits of CE, such ambiguity is both a challenge and an opportunity. Research on science–policy interaction has shown extensively that it can be a challenge to inform policy and practice, as evidence does not provide straightforward courses of action (Cairney et al., 2016). At the same time, this lack of conclusiveness can be an opportunity for "issue entrepreneurs," who promote a new issue in a policy field, to pursue political decision-making that supports particular, individual or group, preferences (Kingdon, 1984).

To aid scholarly engagement with the potentials and pitfalls of diverging assessments, this study brings together (1) policy-relevant lessons and (2) research questions on a sustainable CE, that are key for the CE research community. The article further outlines narratives underlying the lessons and questions, which highlight different scholarly CE interpretations. The results are based on a survey of lessons and questions on how to achieve a "sustainable CE," which did not pre-define CE and sustainability. Fifty-four key international CE scholars participated, having diverse (inter)disciplinary backgrounds, subsequent ontologies, and experiences working toward transformational knowledge and action for sustainability. To condense lessons, map repeating scholarly CE interpretations and develop a shared research agenda, a core research team summarized and grouped the lessons while the survey participants ranked and discussed the questions in a process inspired by Delphi methods (Figure 1, also see Section 2).

The results present the first systematic examination of policy-relevant knowledge for a sustainable CE, with new insights not covered in traditional literature reviews. The research agenda offers a unique group opinion across different CE interpretations. Based on these novel insights, this study proposes three avenues to aid scholarly dialogue on the potentials and pitfalls of the CE's ambiguity to (1) support informed conclusions on available knowledge and (2) reflexively engage with calls for policy-relevant CE research.

2 | METHODS

To identify current policy-relevant lessons on a sustainable CE and propose a research agenda, the core research team (as specified in the author contributions) conducted an expert survey with 54 key CE academics in a Delphi-inspired process for creating a research agenda together with survey participants (Egfjord & Sund, 2020). This process took place online between April and October 2020 and involved a series of methodological

steps, which are defined in the following sections. Expert anonymity was ensured in steps 2, 3, and 4, whereas participants interacted in step 5, which included group discussions enabling a unified definition of the research agenda. This Delphi-inspired process is well suited to identify and prioritize problems and actions by enabling expert-based brainstorming, thus consolidating and evaluating a particular problem or question (Häder, 2002; Okoli & Pawlowski, 2004; Seuring & Müller, 2008). Expert-based brainstorming and discussion formats have also been applied successfully to develop comprehensive, policy-relevant research agendas (Greenhough et al., 2020; Sutherland et al., 2006).

2.1 | Step 1: Identification and selection of experts

The study relies on experts who have a deep understanding of the topic under analysis, instead of statistical representation (Okoli & Pawlowski, 2004). As suggested by the Delphi method, a Knowledge Resource Nomination Worksheet (KRNW) was used to find, identify, and finally select these CE academic experts. Three main criteria were used: (1) publication in relevant scientific peer-reviewed journals, (2) expertise, and (3) coverage of disciplines in the social and natural sciences and engineering.

The core research team consulted the most recent bibliometric results reported by Geissdörfer et al. (2017), Merli et al. (2018), and Prieto-Sandoval et al. (2017) to identify the main journals publishing CE research. The experts are authors of articles published in 13 different journals. To generate the first list of authors, a search was conducted on Web of Science to find articles published in each journal, including the term "circular economy" in the title, abstract, and/or keywords. As of April 9, 2020, 1481 articles were found, 75% of which were published in the *Journal of Cleaner Production; Resources, Conservation and Recycling; Sustainability;* and *Waste Management*. Additionally, this list was complemented with high-impact articles that might not have been published in these 13 journals. On Web of Science, articles tagged as "highly cited in the field" and "hot papers in the field" were selected. Using the search string "circular economy," 117 articles were found.

After finding the authors, their CE expertise was assessed. This was done by identifying authors with at least three publications, which was indicative of an extensive dedication to this research topic. Two hundred and sixty-six authors complied with this criterion. However, the use of "circular economy" in an article is not always indicative of research conducive to policy-relevant findings. For instance, some authors showed a stronger focus on experimental research to test new materials or components at the lab scale or to optimize engineering processes. Although equally relevant for a CE, technical profiles with less emphasis on political and societal processes were excluded. To do so, publications and author profiles were reviewed individually and 83 of them were excluded.

Finally, the disciplinary background of the authors was reviewed to ensure the coverage of social and natural sciences and engineering disciplines. Given the predominance of natural science and engineering, additional authors were searched. Members of exemplary third-party funded CE projects with an interdisciplinary approach were included. Experts from underrepresented disciplines, such as anthropology, were found through CE seminars and events. This process added 11 researchers to the pool of experts.

On May 14, 2020, 179 invitations were sent out via email after removing some authors whose contact details were not available. Invitations included a detailed calendar with the different steps of the research where expert involvement was expected/encouraged and directed the recipients to the survey and later to the subsequent rounds of brainstorming and review.

The survey secured the extensive input of 54 experts. While the recommended size of a Delphi panel is 10 to 18 experts (Okoli & Pawlowski, 2004), we took advantage of the study's virtual format to extend the discussion to a larger group of experts and, thus, make it more comprehensive. Certainly, the study does not cover all possible scholarly viewpoints and the participants' background unavoidably influenced the results. Nevertheless, the general topics that emerged would likely surface if this process was replicated with a similarly large and diverse group of participants.

2.2 | Step 2: Collecting learnings and research questions

Upon receipt of the invitation, experts were asked to fill out an online survey by June 5, 2020 (see Supporting Information S4). The questions were divided into two blocks. The first block aimed to collect background information, including the main research focus (i.e., disciplinary, interdisciplinary, or transdisciplinary), the main disciplines, the focus areas of the expert's CE research in the past 5 years and the number of years they had been integrating this concept into their research. The second block asked two open-ended questions:

1. "Based on your research on the circular economy, what are the three most important policy-relevant learnings that facilitate or hinder a socially just and environmentally sustainable transition?" Three scales (local, national, and international) were suggested to structure the relevance of the findings.
2. "In your opinion, what are the three most important questions that should guide future policy-relevant research on the circular economy?"

The 54 experts who filled out the survey were invited to consult with their colleagues and asked to report the number of people they discussed with. As a result, 18 collaborators were consulted. Supporting Information S4 summarizes the participants' disciplinary profiles and research focus.

Interdisciplinary research is a dominant profile, with a strong interaction between environmental science, engineering, and social science. The main areas of research include waste, material recycling, resource efficiency, business models, and CE conceptualization.

2.3 | Step 3: Analyzing the learnings

The core research team qualitatively coded the pool of policy-relevant lessons following an interpretive approach (Keller, 2012; Yanow & Schwarz-Shea, 2015). One member of the core research team was responsible for identifying and condensing the lessons formulated by the participants in their answers. Some were excluded because they were not formulated as lessons or were not clear enough. The first list of lessons was discussed within the core research team. A different member of the core research team conducted a second coding round to review the initial text and propose grouping categories. The core research team reviewed the new list and defined a set of categories, thus achieving intersubjective plausibility (Sousa, 2014).

Since the lessons diverged largely in terms of their stance toward a CE, they were grouped into three narratives, that is, more critical toward CE and its potential for change (skeptical narrative), more cautiously optimistic (reformist narrative), or very optimistic (optimist narrative). Using these three narratives, the lessons were further split into the political, social, economic, environmental, and research dimensions involved in CE research (see Supporting Information S1).

Each lesson was then assigned to each narrative and dimension. To identify overlaps and shorten the formulations, they were split among the core research team and discussed in a final round to ensure an agreed interpretation. The core research team condensed the lessons and gave structure to the narratives of each position. The experts were then invited to provide feedback on the final summary document. The core research team implemented changes on the formulations accordingly. Additional content suggested by the participants was not integrated into the final list in order not to jeopardize the validity of the methodological process.

2.4 | Step 4: Grouping and prioritizing research questions

The survey generated 124 explicit research questions and several normative statements. In order to reduce the interpretive bias, normative statements were excluded from the analysis. Most of the questions were not altered. However, a few showed similarities and the core research team grouped them into a single question. This grouping reduced the final list to 78 questions (see Supporting Information S4). Given the wide range of topics and questions collected, the next step was to select a reduced number of research questions in order to define priorities for future policy-relevant and high-impact research. On June 22, 2020, the experts who had previously completed the survey were asked to select 10 questions. To ensure transparency and an agreed understanding with the experts, the regrouped questions were listed in an appendix. Experts were also asked to identify overlapping or similar questions and to provide feedback on the formulations.

The core research team initially created categories to structure the list of questions. However, reaching a consensus was not possible, as various formulations were not clear. The questions were not further grouped into categories because this might have generated a selection bias among the participants influenced by a subjective grouping.

Forty-one experts participated in this round. The votes cast for each question were accounted for to create a ranking. The top 20 questions, which received at least 8 votes each, obtained 52% of the total votes and were thus prioritized for further discussion. However, the experts provided divergent views around the similarities and overlaps among the initial 78 questions. The questions considered to be similar to one or more of the top 20 questions were listed alongside their counterparts to help refine the final list in the group discussions.

2.5 | Step 5: Refining research questions

On July 13 and 15, 2020, four discussion sessions with the experts were organized (two sessions per day, 1 h each). The aim was to formulate research questions that could be operationalized in academic research and that are understandable to experts from different disciplines. Discussions were held in the form of an online video conference. Based on their availability, experts were randomly split into eight discussion groups (two groups per session). Each group was contacted in advance and provided with a list of 2–3 questions from the top 20 to be discussed during the session. The questions were paired/grouped according to the similarities indicated in the previous round of feedback. Thirty experts and the core research team participated in the discussions.

Each 1-h session had the same structure. Participants introduced themselves and a moderator from the core research team explained the goal of the session. The rules were clarified: (1) questions needing clarification could be reformulated as needed, (2) if they included a mix of concepts or were too long, participants were allowed to formulate a general research question and a maximum of three sub-questions, and (3) if the questions to be discussed showed overlaps, they could be combined. Depending on attendance, each group consisted of up to five experts, a moderator, and a

TABLE 1 Questions for policy-relevant research on a sustainable circular economy

CONCEPTUALIZING A SUSTAINABLE CIRCULAR ECONOMY	
Re.	1 What does the socio-economic system need to look like to support circularity principles and be socially, environmentally, and economically sustainable in different regions? 2 How can the circular economy objectives be linked to the different SDGs and other major environmental and social development targets?
Sk.	3 How can circular economy conceptualizations address the challenges posed by economic growth models, such as the physical constraints of resource and ecosystem regeneration? 4 How can we determine whether or not sufficiency is part of the circular economy and how can we define it?
TRANSFORMING TO A SUSTAINABLE CIRCULAR ECONOMY	
Op.	5 What are the potentials and limitations of harmonization of circular economy policies across countries (e.g., within the EU, countries with different development stages)? 6 What harmonization of policies between levels and scales is needed to support circular practices? 7 How can policies be designed and integrated to increase material resource efficiency at every stage of the life cycle of products and services?
Re.	8 How can we transition to an environmentally sustainable circular economy through outcompeting the linear economy in a given socio-economic system? 9 What mechanisms can ensure that policy and practice support a systemic societal change toward a circular economy? 10 What existing policy options and what new transformative policies enable a sustainable circular economy? 11 How do we leverage a better understanding of the relationship between the formal and informal industrial and service sectors to generate a just transition to a circular economy? 12 How could we move to circular economy business models that are appropriate for countries in different development stages?
Sk.	13 Can or should linear economic systems be dis-incentivized and circular systems incentivized, and if so, how?
MONITORING CIRCULAR ECONOMY TO ENSURE SUSTAINABILITY	
Re.	14 What are the suitable indicators to measure progress toward circularity and to assess the sustainability of the emerging circular society? 15 How can we ensure that circular economy initiatives avoid negative effects, including but not limited to, tradeoffs and rebound effects? 16 How can we assess what scale is suitable in order to reach circular economy goals given the characteristics of the specific product systems? 17 What tradeoffs does the implementation of circular systems generate in different geographic and organizational scales? 18 How do we allocate social, environmental, and economic costs in circular supply chains from extraction through design, manufacture, retail, use, and disposal to recycling?
SCIENCE–POLICY INTERFACE FOR A SUSTAINABLE CIRCULAR ECONOMY	
Re.	19 What are the different pathways in the science–policy interface that make circular economy knowledge taken up by decision-makers? 20 How can life-cycle-oriented sustainability assessment be translated into policy in a circular economy context, given that no supply chain is under the control of a single government or a single sector?

The left column indicates the narrative each question is based on (Op, optimist narrative; Re, reformist narrative; Sk, skeptical narrative). Due to space limitations, this list of final questions does not include sub-questions developed during the Delphi-inspired exercise. These can be found in Supporting Information S2. The final questions and their sub-questions are the result of collaboratively condensing the 78 original questions proposed by the participants (Supporting Information S3). For more details on the process, please see the Section 2.

note-taker, who also took an active role in the redefinition of questions. All participants were able to follow the discussion using a shared document where all changes, comments, and suggestions were documented. In some instances, moderators referred to the questions listed as similar in the ranking step to identify supporting concepts. When participants did not finalize their set of questions by the end of a session, the core research team consulted their notes and sent a suggested formulation to the group. Participants either approved or provided feedback on the new question.

Once all questions had been discussed, the core research team reviewed the new list to identify overlaps and potential categories. The final list of agreed-upon questions (Table 1) and sub-questions (Supporting Information S2) was shared with all participants to receive written feedback about the categories and formulations. Finally, the core research team implemented changes on the formulations. Similar to the lessons (Step 3), comments referring to missing content were not integrated into the final list in order not to alter the validity of the methodological process.

2.6 | Limitations

This study has some limitations in the interpretation and development of the three narratives and the elaboration of the research agenda. Only academic experts were included, as the results are meant to characterize current scientific efforts and lessons to further inform future research.

Further, this analysis addresses policy-relevant research for a sustainable CE in general, leaving room for adapting this knowledge to specific geographical scales or socio-economic sectors. Research agendas targeting certain sectors (e.g., food waste management) will benefit from integrating knowledge and experiences from stakeholders, including practitioners, policymakers, and civil society.

Given the online configuration of this analysis, which was due to COVID-19 restrictions as well as the invitation of a broad set of international experts, the number and duration of the live discussion rounds was limited. To mitigate this limitation, several rounds of written feedback were undertaken to enable extensive feedback on the final list of research questions and the grouping of lessons into narratives. However, longer, in-person workshops would have enabled a more in-depth discussion of the results, allowing and ensuring that all participants provided input to fill in existing gaps. For this reason, some dimensions are less prominent in our results, as they were not mentioned in the initial survey. Speculative reasons for why certain areas were less addressed could be "group-think" dynamics during discussion rounds, bias, that participants did not think they relate to policy or simply that they do not conduct research on the topic. To account for this limitation, feedback on observations and statements resulting from the survey was integrated in the results and discussion sections of the manuscript but not in the raw data in order not to alter the original lessons formulated by the experts.

3 | RESULTS

3.1 | Narratives of policy-relevant lessons for a sustainable CE

The 54 survey participant's insights highlight lines of convergence and divergence about policy-relevant lessons for a sustainable CE. These synthesize three ideal typical narratives: optimist, reformist, and skeptical (Figure 2, detailed lessons in Supporting Information S1). This article uses narratives to structure the lessons because scholars habitually narrate to reduce complexity and connect the past, present, and future, particularly when making sense of complex, future-oriented change (Grin et al., 2010). A narrative is a story that ascribes meaning to social or physical phenomena and provides an interpretation of who or what is significant (Hajer, 1995). The optimist, reformist, and skeptical CE narratives hold different ontological viewpoints, determining what is real in the world and what is relevant for a sustainable CE. These narratives provide novel insights into convergence and divergence of scholarly views on policy relevance and societal change, complementing results on scholarly CE narratives developed based on scientific literature (Friant et al., 2020).

First, the **optimist narrative** takes CE as a fundamental part of sustainability transformations and suggests specific actions to reach a sustainable CE. Second, the **reformist narrative** argues that the CE has transformative potential but only if social and environmental boundary conditions are met. This narrative anticipates that good policy (design and implementation) could use the CE concept to ignite and advance a sustainability transformation, if status quo interests are overcome and potential rebound effects or burden shifts are addressed. Finally, the **skeptical narrative** questions the general usefulness of a CE for sustainability transformations. Based on the perception that CE is an empty concept that is unreflective of the consequences of economic growth, this narrative expects that the concept serves business-as-usual practices or may accelerate environmental degradation by fostering economic growth with no (or only relative) decoupling from resource consumption.

The **optimist narrative** takes CE as a driver for sustainability transformations. Particularly in the political theme, it is noteworthy that the majority of the lessons hardly touch on CE objectives but assume that these are implicitly clear and beneficial for a sustainability transformation. This narrative considers CE as the only form of human development within planetary boundaries. Consequently, lessons focus on what is needed to achieve a CE, which is usually resource efficiency policies and business action at the local or national level, for example, Eco-Design or Extended Producer Responsibility. While some lessons suggest awareness raising to promote CE behaviors and lifestyles, education policies hardly appear. In the economic dimension, CE is portrayed as a powerful metaphor that breaks silo thinking, engages companies, and provides economic benefits. At the same time, many lessons argue that the economy requires more or better steering through policies. Hence, political action plays a much more influential role than economic or technical aspects. Notably, these lessons do not correspond with current EU institutions' CE narrative, which portrays bottom-up market forces and economic incentives as CE drivers (Friant et al., 2020; Leipold & Petit-Boix, 2018; Zink & Geyer, 2017). Despite the optimist narrative's focus on policies, many lessons still highlight the need for new business models, data, and technology to deploy a sustainable CE.

The **reformist narrative** connects risks and disadvantages related to the CE to policy. Lessons often anticipate that good policy (design and implementation) could use the CE concept to ignite and advance sustainability transformation. Yet, policies can only do so if they overcome two key problems: the resistance of status quo interests and the growth of resource consumption, emissions, and socio-economic material stocks (infrastructures, buildings, and products). In this narrative, political action and consumption–production patterns are more critical for CE development than technological advances. Yet, political, social, and economic change needs to foresee and mitigate greenwashing, rebound effects, and burden shifting. However, some lessons raise the issue that not enough room for innovation or experimentation exists. Furthermore, the reformist narrative suggests taking measures to expand our knowledge and action on social dimensions of a CE, for example, consumption habits, ownership, working conditions, lifestyles, as neglecting social dimensions limits a CE's potential from a triple bottom line perspective.

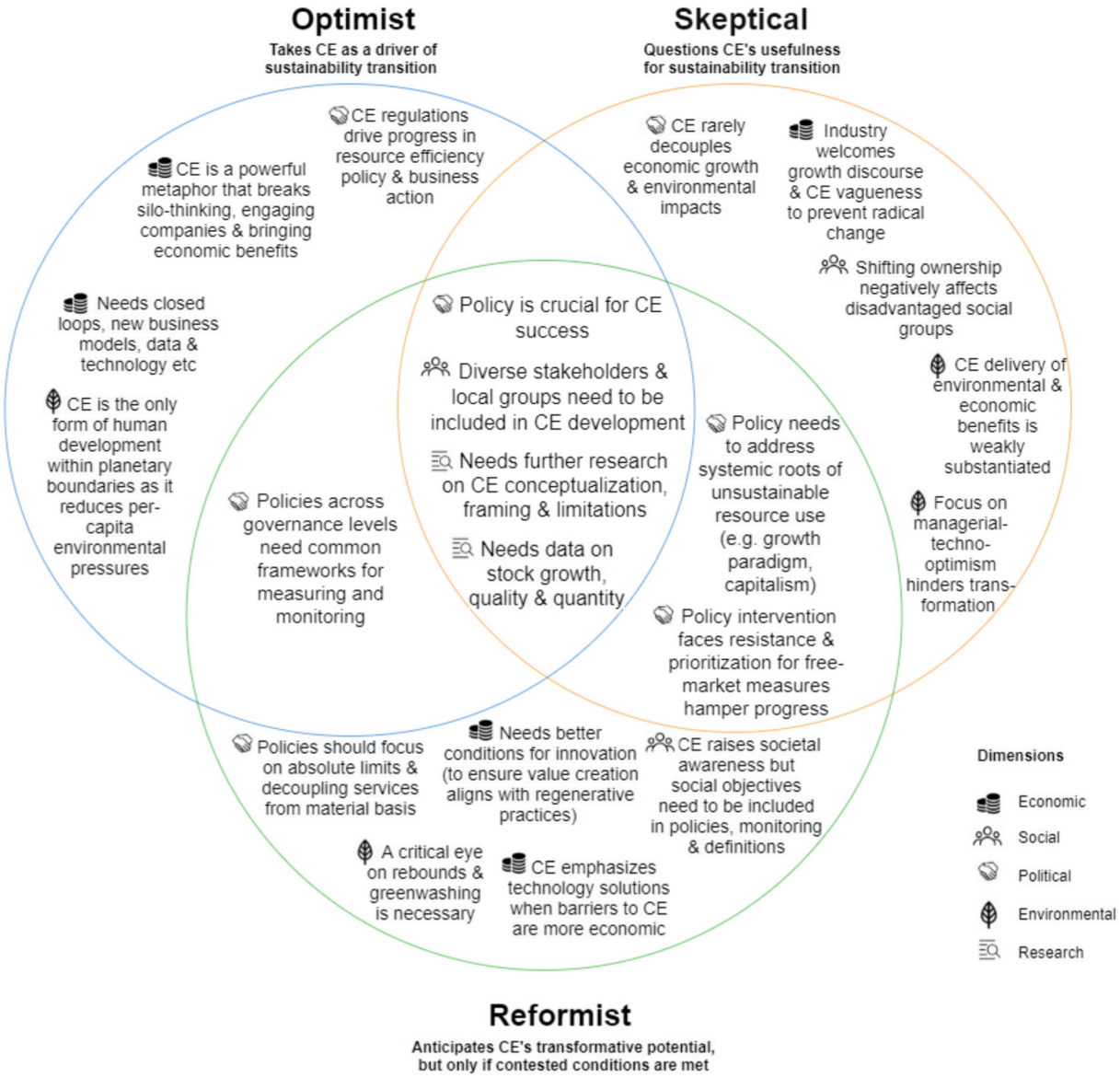

FIGURE 2 Narratives of policy-relevant lessons on a sustainable circular economy. Images: Flaticon.com. The diagram shows the ideal typical narratives drawn from policy-relevant lessons collected from the study's expert survey (see Section 2). Selected statements highlight the main lines of convergence and divergence of the three narratives. These results are a condensed version of the detailed lessons shown in Supporting Information 1. The narratives group lessons and not experts, who may draw on different narratives depending on the context. For better readability and overview, the lessons were grouped into dimensions—economic, social, political, environmental, and research

The **skeptical narrative** questions a CE's usefulness for sustainability transformations. It expects that the concept serves as an excuse for business-as-usual or opens possibilities for accelerated resource consumption by promoting economic growth. Accordingly, economic lessons of this narrative argue that business-led circularity is a myth. Instead, businesses are understood as using the CE concept's vagueness to prevent rather than promote value retention of materials. While this critique is similar to the reformist argument regarding the resistance of status quo interests (e.g., fossil fuel industry) and the danger of greenwashing, the skeptical narrative differs significantly by questioning whether CE policy can overcome status quo resistance or the deep-rooted economic growth paradigm. In the social dimension, this narrative highlights that shifting ownership models, for example, moving to sharing/rental models, may exclude disadvantaged groups in society and these groups will bear the costs of a CE transformation as currently envisioned by the optimist narrative. This neglect of disadvantaged groups will lead to considerable resistance to change. Furthermore, such change would not be a "real" social transformation but rather "managerial-techno-optimism" (Supporting Information S1). Under this narrative, a CE requires a reorientation of the current socio-economic system, for example, to de-growth or well-being indicators, at which current CE efforts are failing. Therefore, this narrative argues that available evidence only weakly substantiates the environmental or social benefits of current CE implementation efforts.

Across all three narratives, the lessons portray policy interventions as crucial for CE success, although each narrative qualifies them differently. While the optimist narrative argues that CE policies need coordination across governance levels and monitoring, the reformist narrative highlights the need to overcome vested interests, and the skeptical narrative argues for policies addressing fundamental issues of growth and capitalism. Next to the emphasis on political intervention, the lessons in all three narratives highlight the importance of social processes and participation for sustainable CE development, specifically calling for the inclusion of diverse (local) stakeholders. Finally, many lessons call for a "common language" or a shared CE conceptualization and framing as well as an understanding of limitations (e.g., in-use material growth, quality, and quantity).

3.2 | Research priorities for the future

To develop a shared research agenda, the 54 survey participants suggested, ranked, and discussed a broad array of research questions critical for policy-relevant CE knowledge (see Section 2), which mirror the concerns and positions identified in the three narratives. A list of 20 questions, categorized into four thematic groups, resulted from this exercise (Table 1). As the research questions set a broad agenda, each requires further operationalization in socio-economic, geographic, sectorial, and political contexts. Nevertheless, the research questions point to four key priorities for the future, in line with the thematic groups stated in Table 1:

1. **Consensus building on what constitutes a sustainable CE**. This priority area highlights the need to reflect on the overall goals, definitions, boundaries, principles, and associated practices of a CE as suggested by Korhonen et al. (2018) and Blomsma and Brennan (2017), among others. It further calls for research linking CE with wider socio-economic frameworks and objectives (Schroeder et al., 2019) and addressing biophysical resource constraints (Haas et al., 2020). This area aims to address the implications of CE for ecosystems, human well-being, notions of sufficiency, and economic de-growth. Similar calls have been made by other authors such as Hobson and Lynch (2016).
2. **Identify and leverage change opportunities**. The second priority area asks for policy and practice options to enable a CE. It seeks to identify mechanisms, policy designs, and harmonization strategies enabling a CE transformation, as suggested by Fratini et al. (2019) and Milios (2018), while being sensitive to different governance levels, scales, and development stages as suggested by Luo et al. (2021) and Domenech and Bahn-Walkowiak (2019) among others. This proposes new lines of research sensitive to governance issues as noted by Govindan and Hasanagic (2018) and Leipold (2021) and their complexity and heterogeneity within and across nation-states. Not least, this priority area highlights the need to reflect critically on whether circular strategies should (always) be favored over linear (business-as-usual) strategies (Gregson et al., 2015; Skene, 2018).
3. **Assess the environmental, economic, and social costs and benefits of CE strategies and ways to distribute them**. The third priority area focuses on monitoring CE implementation to steer decision-making and to minimize tradeoffs or rebound effects through appropriate and commonly shared CE indicators, as also highlighted by Helander et al. (2019) and Saidani et al. (2019). Competing but complementary approaches need to be critically assessed and integrated, as some focus on single products, materials, and business models, whereas others assess the entire economy and its relation to (global) environmental goals and strategies (Haas et al., 2020; Saidani et al., 2019). It also calls for the identification of societal and political strategies that ensure an adequate distribution of costs and benefits in society as suggested by Hobson (2021) and Simoens and Leipold (2022) among others, taking geographical and cultural differences into account (Deutz & Lyons, 2015).
4. **Reflect on the role of science in supporting CE development**. This priority area is concerned with research that investigates the role of CE knowledge in political contexts as suggested by Giampietro and Funtowicz (2020) and when questions of negotiation and decision-making power are involved. It suggests exploring the opportunities and limits of science communication and the collaboration of scholars with stakeholders.

As this agenda emerged from a Delphi-inspired process, which aims at determining a group opinion, some important research areas that did not receive enough votes were left out of the final questions (see Section 2). However, participants pointed them out in their feedback and the core research team identified these topics to be commonly addressed in the CE literature. These include the demand side of the CE, especially the role of civil society (e.g., NGOs) and consumer acceptance of circular offerings and adoption of circular lifestyles. These were included in the original list of research questions suggested by the study participants (see Supporting Information S2 and Section 2) and some of the final questions do use terms such as "incentivize" or "engage," which may implicitly address consumers. However, most of the final questions are oriented toward political and supply-side measures. Such questions have also been highlighted by previous work, for example, Ghisellini et al. (2016) or Lieder and Rashid (2016). Furthermore, research on strategies aimed at slowing resource loops (e.g., sharing economy, collaborative consumption, remanufacturing, reuse, eco-design, second-hand, product-service system) as well as research on individual enterprises, innovation, and the role of technology in achieving CE goals, require more detailed attention. Although these aspects were not ranked among the most pressing research questions, they feature in the lessons (see Supporting Information S1) and have been subject to previous agenda-setting exercises. For instance, Camacho-Otero et al. (2018) explore consumer engagement in a CE from a social perspective and among others Jabbour et al. (2019), call for more engagement with managerial practices and (new) digital technologies in circular supply chains.

Another underrepresented research area that crosscuts the former two are behavioral aspects. Some research addresses issues of sustainable behavior specifically in a CE context (Daae et al., 2018) and thereby touches upon the role of the user's responsibility. Researchers argue that some consumer segments would respond to mere information provision, whereas others will need compelling design or force to behave according to circular principles. To understand how individuals and enterprises behave when faced with certain regulations, economic incentives, or innovations, existing studies call for more research on environmental management systems and the diffusion of circular criteria and requirements in existing processes and eco-labels (Boyer et al., 2021). Related to these topics, the agenda (Table 1) does not include explicit questions on international agreements and global trade for a CE, which recently emerged in research (Luo et al., 2021).

Finally, the agenda does not include explicit questions on (shared) terminology or theoretical frameworks, despite the prominent role given to conceptualizing a sustainable CE. The use and meaning of different terminologies were, however, a recurrent issue in the discussions about research question formulations among the different researchers. Therefore, all research questions were formulated broadly, as their operationalization depends on disciplinary methods and conceptualizations. The absence of shared CE terms and theoretical frameworks can partly be explained by the multiple disciplines involved. In addition, conceptual and terminological ambiguity makes CE attractive and inspiring to diverse researchers (Blomsma & Brennan, 2017).

The proposed research agenda is, to our knowledge, the most comprehensive so far. It covers all areas of a CE instead of specific approaches, sectors, technologies, or regions. While some of the suggestions are not novel as standalone issues, viewing them together provides a comprehensive overview of major uncertainties and points of contestation in the CE research landscape. Thus, it provides a first overview of research concerns based on different CE narratives. This comprehensive view will play an important role in facilitating the development of socially relevant research, and incorporate various visions, understandings, and legitimizations into scientific endeavors.

4 | DISCUSSION AND CONCLUSIONS

The prevailing enthusiasm surrounding CE offers a unique opportunity to advance the impact of research on sustainability transformations. The inclusion of life cycle and business perspectives alongside questions of social inequality, policy harmonization, and global trade in the CE community's lessons learned and research agenda highlights the CE as a unique orienting point to address the interdependency of these concerns. At the same time, this complexity produces ambiguity—which some scholars view as an obstacle to the creation of policy-relevant CE knowledge. To help scholars navigate and communicate CE knowledge, this analysis suggests three avenues for CE researchers to better comprehend and manage the challenges and opportunities arising from this ambiguity.

First, this study suggests a deeper **reflection on the problem description and narrative underpinning CE studies and comparing it to results from within and beyond CE research**. Researchers habitually discuss the quality of their data and analyses. While this is vital to science, potentially transformative CE knowledge can only emerge if scholars critically reflect on the narratives they adhere to as individuals and as a community. Existing CE literature has attributed ambiguous and contradictory results and conclusions with a strong focus on concepts and too little assessment of real-world processes (Gregson et al., 2015; Leipold & Petit-Boix, 2018), diverging conceptual foundations (Friant et al., 2020), and a misinterpretation of core concepts (Skene, 2018). While these are important explanations, our analysis points to underlying CE narratives as an important factor driving the ambiguity of assessments. CE narratives do not just produce different insights on the same phenomenon from different perspectives or scales. They determine the choice of subject, data, and research questions, as well as the policy recommendations scholars (can) make. The optimist narrative, for instance, bears the risk of finding success stories of new policies or business models (e.g., increasing the recycling of materials) without proving that these actions contribute toward the desired socio-environmental sustainability. At the same time, an overly strong focus on the overhaul of the economic or societal system (skeptical narrative) risks overlooking innovations contributing to new economic thoughts and practices. Finally, the reformist narrative's focus on the "right" means to realize a CE and the mitigation of negative effects may push necessary debates about a CE's desired ends and goals into the background, thus contributing to an increase in diverging CE interpretations. Reflecting on such limitations of specific ontologies will transform ambiguity into an opportunity to support informed conclusions on the range of available knowledge. For instance, it could enable joint studies of optimist, reformist, and skeptical viewpoints at the same scale and topic, for example, specific business models. Such engagement would necessitate comprehension of each other's underlying assumptions about how the world works as well as the need to bring in longstanding debates and knowledge on related topics, for example, climate, energy, or biodiversity—which may eventually be most transformative in the sense of drawing a comprehensive picture of a sustainable CE. The results of this endeavor could enable or outbalance issue entrepreneurship, that is, actors actively promoting new or previously ignored issues in a policy field, and politically strategic decision-making biased against CE's socio-ecological goals.

Second, scholars need to **link technical, environmental, and managerial CE research with studies on social costs and benefits, socio-economic disparities, and interdependencies as well as connected questions of policy design and harmonization**. The research agenda indicates that, if scholars aim for "systemic," "holistic," or "cross-sectoral" CE thinking, such interdisciplinary links are critical. To do so, researchers could draw upon a multitude of methods that sustainability scientists have developed for reflexive, collaborative, inter- and transdisciplinary research (Keitsch & Vermeulen, 2020). Recent tools were developed, for instance, to reflect on research stances(Hazard et al., 2020), develop action-oriented knowledge for sustainability, and enhance social learning across technical, managerial, social, and political perspectives (Caniglia et al., 2021).

Third, **exploring the opportunities and limits of science communication and the intricacies of science–policy interaction is pivotal**. if CE research aspires to be policy relevant and transformative. Disclosing narratives and the underlying ontologies of CE research, along with public consultation, would be a first step. This could be realized by integrating the wealth of literature on knowledge co-production (Norström et al., 2020) and on the role of science in past processes of social change and transformation (Caniglia et al., 2021) in CE thinking. Such engagement would foster a less biased engagement with stakeholders and help close the knowledge gap on the role of science in CE development.

Engagement with underlying narratives, technical, managerial, social, environmental, and political CE perspectives and science–policy interactions is a challenging task for research departments largely organized along disciplinary lines, constrained by short-term funding, and pressured to produce immediate scientific output. Yet, such an endeavor is an important and necessary task if CE research strives to contribute advice to policy and practice that meets pressing sustainability challenges. Although these issues are not unique to CE research, the current growth of focus on CE offers particularly strong reasons to spearhead discussions to address them.

AUTHOR CONTRIBUTIONS

The core research team includes the five individuals named below. Sina Leipold conceived the first research idea, developed the research design together with Anna Petit-Boix, and took the lead in writing the manuscript. Anna Petit-Boix, Sina Leipold, Anran Luo, Hanna Helander, and Machteld Simoens conducted the research process and analysis and edited draft versions of the manuscript. As the lessons and research agenda emerged from a collaborative process, the core research team followed the CRediT taxonomy and invited everyone as author who participated in at least three steps of the research: (1) resources, (2) validation, and (3) writing, review, and editing. To do so, the manuscript draft was shared with all participants who made substantial contributions to the generation, reflection, and refinement of the policy-relevant lessons and research questions. They were invited to suggest revisions to the manuscript draft and, in light of their participation in the process, to be co-authors. Based on the different contributions, the core research team is listed as the first five authors. All authors following Machteld Simoens are listed alphabetically.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The collected data is available in the manuscript or the supporting information.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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