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The (missing) social aspect of the circular economy: a review of social scientific articles

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Abstract

Academic research on the Circular Economy has been proliferating at an unprecedented pace during the last decade. However, scholarly work on the topic is dominated by a focus on hard scientific, technical and corporate/business management approaches, leaving the social sciences underrepresented in the relevant literature. This review article covers the current Anglophone social scientific research on the circular economy with special attention to waste. A total of 161 works aligning with the scope of this article were examined. These works were analysed in light of two questions: the reviewed studies' knowledge interest and the dimension(s) of the CE they gave emphasis to. In result, the articles were charted along two axes: Instrumental/Technical (Quadrant I), Analytical/Technical (Quadrant II), Instrumental/Social (Quadrant III), and Analytical/Social (Quadrant IV). The findings of this review article demonstrate a strong thematic interest related to the circular economy in global, major issues of governance; transition and implementation; consumption and consumer behaviour; as well as the associated logic, concepts and definitions. A weaker thematic interest appeared in relation to the cultural, political and ethical dimensions of the circular economy, while critical engagements with and contestations of the model remain fairly rare. Moreover, the analysis revealed the relative absence of detailed empirical scholarship on the more-than-human relations and the micro-level, local everyday practices through which the circular economy becomes actualised. This review calls for the proliferation of such works currently situated in the margins of the circular economy literature. However, as is finally proposed, a balanced mapping of a circular economy transition would require an approach that would problematise levels, scales and dichotomies like 'global' and 'local' as categorical givens.

Keywords Circular economy, Literature review, Social sciences, Waste

Introduction: the success story of the concept of circular economy

The circular economy (hereafter CE) has become a political and economic buzzword, having gained increasing prominence over the past couple of decades. It is seen as a significant tool to mitigate and deal with growing concerns about ecological unsustainability, resource depletion, and the crisis of waste. Not only is the CE championed by such major agents as the European Commission, multinational companies, management consultancies, and NGOs, but it has also attracted a lot of attention among academics. Research on the CE has been proliferating at amazing speed: while in 2000, according to the Web of Science, there were only 3 articles published on the topic that year, in 2010 the respective amount was 133, and by 2022 it had multiplied to over 4000 articles.

The idea of a closed circular system itself is not new; 'closing the loop' and 'waste-to-resource' schemes had been circulating in political, economic, and academic discourses for decades before the CE became a model concept and ideology. It is customary to trace the early theoretical foundation of the concept to the notion of 'spaceship Earth' [1] by Kenneth Boulding, which already refers to closed systems, circularity, and the finite nature of resources.[1] In addition, the idea of resource recovery

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from wastes was promoted and explored already in the 1960s and 1970s by some authors in the field of sustainable economics [2]. For example, in the article 'Solid Wastes: A Resource?' [3, p. 1598], agricultural economist Joseph Havlicek and his colleagues observe the existence of 'an almost unexplainable void in economic analyses of solid waste disposal', and set out to fill this gap in the existing literature. The authors also identify two conflicting approaches to waste disposal: the 'destroy and get rid of' approach and the 'useful resource' approach. For the latter, solid wastes are treated 'as inputs in creating things of value' [3, p. 1599]. The paper by Havlicek and his colleagues was followed by a number of other papers examining and developing the economics of resource recovery from solid waste [4–7].

The environmental movement of the 1970s played a significant role in promoting sustainability concerns and raising public awareness of the importance of recycling. But the practical roots of the idea of the CE go even further than the 1960s and 1970s, to early recycling practices. Historian Susan Strasser likens pre-industrial society to a sustainable ecosystem insofar as it was a more or less closed, circular system [8]. The lifespan of objects was long. They were repaired, passed from one class to another and from generation to generation, stored in attics or cellars for later use, and used up. The waste generated was recycled elsewhere. Animal faeces and toilet waste, for example, were sold as fertilisers and things that could no longer be repaired were dismantled and sold as parts—or burnt to heat homes, especially those of the poor.

An important precursor of the concept of the CE was that of 'recycling society'. Japan introduced its idea of a recycling society in the 1970s, stressing the need for waste reduction and resource conservation through recycling and reuse. In academic discourses, the concept surfaced especially in scholarship on sanitation. For example, a new way of thinking and acting about human excrement—a 'closed-loop-approach'—was sketched in a workshop organised in 1999 in Cuernavaca, Mexico [9]. Similarly, in another conference on wastewater management and sanitation organised the following year in Bonn, Germany, Steven Esrey gave a plenary talk, titled 'Towards a recycling society, ecological sanitation – closing the loop to food security', in which he drew a contrast between linear and circular 'attitudes' and addressed what it would take to 'close the loop': 'If we change our linear attitudes of resources and wastes, towards a circular one, we can reconnect these resources and wastes, reduce our problems and advance towards a recycling society' [10, p. 35].

Since the 2010s, the CE has gained global recognition, being vividly present in academic literature, national and international policy directives, and companies' business visions [11, 12]. The Ellen MacArthur Foundation, established in 2010, has played a key role in popularising and campaigning for the idea of the CE [13]. The EU's CE initiatives and policies, too, have significantly contributed to promoting awareness of the CE principles and their adoption by businesses, governments, and organisations.

As the idea of the CE has gained more traction, it has both incorporated the notion of a recycling society but also expanded it. Like the concept of the CE, already its 'predecessor', the notion of the recycling society, assumed a shift from a linear system to one where resources are continually recycled. However, the CE is a broader notion in that it promotes not only recycling but also the imperatives to reject, reduce, reuse, refurbish, and remanufacture. At the same time, and importantly, with the transmutation of the notion of a recycling *society* into a circular *economy*, the economic frame comes to dominate over the societal. While the notion of a recycling society proposed a new framing of resources and wastes based on principles of ecological sustainability, the CE provided these issues with an economic framework. The CE action plan that the EU adopted in 2015 is a case in point, as it suggested that Europe's transition towards a CE would 'boost global competitiveness, foster sustainable economic growth and generate new jobs' [14].

Accordingly, while the ideas of circularity, environmental sustainability, and resource recovery from waste had been present in various forms much earlier, the concept of the CE framed them anew. Blomsma and Brennan anchor the concept in broader discussions and debates about waste and resource management and suggest that while 'the various resource strategies grouped under the CE's banner are not new individually, the concept offers a new framing of these strategies by drawing attention to their capacity of prolonging resource use as well as to the relationship between these strategies' [15].

The aforementioned transition from society to the economy is clearly discernible in the research literature, too. Most of the emerging body of scholarship on the CE is rooted in industrial ecology, which has as its explicit goal to reconfigure industrial practices and systems on the basis of ecological principles. The majority of the research that has so far been conducted on circularity has a corporate and business management approach, focusing on for example business model design, supply chains, technology development, or industrial processes [e.g. 16–25]. The literature review conducted by Schöggl, Stumpf, and Baumgartner on the relationship between CE and sustainable development supports this view [26]. The authors' results indicate that most CE studies are either management or technically oriented and that while the CE literature addresses different environmental

aspects to a limited extent, social aspects are only marginally discussed in this literature. This resonates with the observation by Murray, Skene, and Haynes regarding an absence of the social dimension in the CE model, which according to them 'limits its ethical dimensions' [27].

As the transition towards a CE necessitates and involves not only technological innovations and business development (for example in the form of redesigning products, services and business models to close resource loops and extend the value of products and materials as long as possible), but also a fundamental change in society and how we live, the social or sociotechnical and sociocultural underpinnings of the CE transition deserve more attention than they have been given in the research literature so far. Lindkvist and Baumann noted some ten years ago that social scientific perspectives have received fairly scarce attention within industrial ecology [28]. The same goes for the bulk of the research on the CE even today.

To render the social aspect more visible and argue for the important contributions of social scientific perspectives to the CE discourse, in this literature review article we focus explicitly on *social scientific studies on the CE*.[2] Social scientific insights and perspectives, as Blomsma and Brennan suggest, are crucial for both the theoretical development of the concept of the CE and its implementation [15]. The focus on social scientific studies is further motivated by an aspiration to add thematic diversity to the mainstream of CE research. Schöggl, Stumpf, and Baumgartner observe that while the CE literature has grown exponentially, the thematic diversity of the literature has increased very slowly [26].

The article is structured as follows: In the following section, we discuss the framework of our literature review, our data and the methods of conducting our literature searches. After that, we categorise social scientific literature on the CE into four quadrants along two axes, instrumental vs. analytical and technical vs. social, and present quadrant by quadrant what kinds of works appear in each. Finally, we draw conclusions based on our review of the literature.

Framework and data

Despite the remarkable popularity of the idea and the increasing amount of work recently published on the CE, it is striking how vague and elusive the concept itself has remained. The research literature is still lacking a commonly accepted definition of the CE [29]. A systematic analysis published in 2017 by Kirchherr et al. of research literature observed that the concept is used and interpreted in remarkably various ways; the authors identified as many as 114 different definitions for the CE [30]. In a more recent review article revisiting the topic, Kirchherr and his colleagues found an even greater number of definitions: 221 in total, all published in academic articles that appeared after the publication of their earlier paper [31]. Given the contested nature of the concept, it is thus hardly a surprising observation that many review articles set out to define the CE by reviewing the shortcomings of existing definitions [e.g. 30–34].

Besides works aiming to provide a new definition of the CE, there are also review articles that set as their goal to group relevant research and discuss the current state of the art of CE research into different categories via a systematic approach. A prominent example is the article by Merli, Preziosi & Acampora, where an exhaustive account and categorisation of CE-related scholarly outputs is produced, with some unavoidably generic findings that, nevertheless, stress the CE concept as one in the making [29]. However, literature reviews have often narrowed down their coverage either to a particular perspective, such as critiques of the CE [35], or to a certain theme, such as the relationship between the CE and sustainable development [26, 36, 37] or consumption work in the CE [38].

Our preliminary literature search suggested that, from the tens of thousands of scholarly works addressing CE matters, only a very small but proliferating minority scrutinises the CE through a *social scientific lens*. To our knowledge, a review of such works is missing from current literature. Filling this gap, this is the first review article that specifically examines the current CE literature within the domain of social scientific studies. As we maintained in the Introduction, the rationale behind this focus is that social scientific approaches have received fairly little attention in the CE literature, even though a successful CE transition fundamentally involves a societal change and a change in our everyday social practices and relations. Therefore, in this review, we foreground the Anglophone social scientific literature within CE works through its key perspectives and themes. Due to this framework, articles of a purely technical or natural scientific kind, for example within chemistry and engineering, are not reviewed here. We also excluded business studies articles that focused exclusively on economic issues or business management, such as business model development or supply chain management, unless they utilised social scientific methods or approaches, such as ethnography or discourse analysis, to study these issues.

We conducted our bibliographic survey along two channels and set out to identify social scientific articles dealing with the CE by using both Google Scholar and Scopus. On the one hand, we conducted a literature search by going through the articles in Google Scholar

(search terms: circular economy social sciences) that had cited some of the most influential social scientific studies focusing on the CE, such as Hobson [39], Korhonen et al. [11] and Korhonen et al. [12].[3] This returned an initial sum of 134 articles. On the other hand, we performed a systematic literature search via Scopus to identify social scientific works focusing explicitly on the CE and waste. We, therefore, searched for 'circular economy' (within all fields) and with the exact keyword 'waste', while automatically screening for publishing years (from 2015 onwards), disciplines (Social Sciences and Arts & Humanities) and language (English). This initially returned 122 results. Then we did similarly as above but searched instead for 'circular economy' and 'sociotechnical' or 'socio-technical' within all fields (76 results), and after that for 'circular economy' and 'sociomaterial' or 'socio-material' (33 results). Together, and after the removal of duplicate records, these surveys via Google Scholar and Scopus returned a total of 255 articles. After examining the relevance of those articles in greater detail through two rounds of manual screening, we excluded the ones that were out of our scope (e.g. of a predominantly technical, managerial or business focus and from disciplines other than the social sciences and the humanities). This process resulted in 161 articles selected for an in-depth review (see Fig. 1).

The chosen first search method naturally comes with certain limitations, the most obvious among them being articles that have fallen off our radar because they were published before the aforementioned influential works—or do not cite them for other reasons. Due to these limitations, we chose to engage with the social scientific literature on the CE with a special focus on waste in a systematic manner. As a result, this article reviews, to the best of our knowledge, all existing literature on the CE and waste, significantly enriched and contextualised by literature on the CE more generally, within the social scientific domain.

The articles were treated as data which we analysed by means of qualitative content analysis, and via an integrative lens of inquiry that critically analyses and synthesises emergent scholarly fields [40, 41]. We were interested above all in their manner of approach and analysed the articles in light of two questions: first, what kind of *knowledge interest* [42] constitutes their research and, second, what *dimension or dimensions of the CE* each article gives emphasis to. By reading the selected literary corpus through these two questions, we wanted to find out not only to what degree is the research done on the CE practically oriented or characterised by an analytical interest, but also to what extent the social dimension is given attention in the articles reviewed. And, to make the analysis more

Fig. 1 Literature review process—flow diagram

structured, we developed a conceptual classification [43] by grouping the reviewed articles along two axes in relation to the questions: *instrumental vs. analytical* and *technical vs. social*.

The first axis, instrumental vs. analytical, refers to the kind of knowledge that the studies aim to produce (i.e. the question of knowledge interest): are they primarily motivated by and geared to problem-solving and suggesting practical applications and improvements of the CE (instrumental knowledge interest), or do they primarily aim to understand and/or explain the CE or some aspect of it, such as politics, ethics, inclusion or social underpinnings (analytical knowledge interest)? Whereas articles showcasing an instrumental knowledge interest have a more practical orientation, in articles with an analytical knowledge interest scientific knowledge has intrinsic value.

The second axis, that of technical vs. social, refers to the extent to which the articles reviewed emphasise either the technical or the social dimension of the CE (i.e. the question of dimensions). So, this axis has to do with how the articles conceive the CE: do they focus mainly on such technical matters as management, policies, business models, industrial systems, and technological devices, or do they stress more the social aspects and preconditions of the CE, such as consumer practices, cultural values and schemes, social class, social institutions, or social relationships (including e.g. socio-technical or socio-material relations)?

Based on the two aforementioned axes, we positioned each article reviewed in one out of four quadrants: instrumental/technical (Quadrant I), analytical/technical (Quadrant II), instrumental/social (Quadrant III), and analytical/social (Quadrant IV). When doing so, we also quantified the dispersion of the articles quadrant by quadrant. It should be noted that, as is the case with categories more generally, this categorisation is somewhat crude and comes with unavoidable limitations. For example, some of the articles reviewed address both technical and social aspects of the CE. In such cases, we placed such an article into either one of the two categories depending on which aspect we deemed it emphasises (even slightly) more (which is always a matter of interpretation, not a brute, self-evident matter of fact). In any case, however, the approach we followed in terms of categorising the sources identified avoids linearity and strict hierarchisation. It is rather characterised by a spectral lens, since most of the works included in this article cannot fit within a single main category. In what follows, we briefly discuss all the articles selected for review. We acknowledge that there may exist articles we have missed. Nevertheless, the review gives the reader an overall picture of the state of the art of Anglophone social scientific studies within the CE literature, together with their varying themes and perspectives.

Social scientific literature on the circular economy

In this section, we provide an overview of the emerging body of social scientific research on the CE categorised along the two aforementioned axes. We discuss the key topics, themes and perspectives of the discussions and debates in each quadrant. As will become clear, the articles are not divided into the quadrants evenly, but some quadrants are more represented in the literature than others.

Quadrant I: instrumental/technical

In this subsection, we discuss studies that emphasise some of the 'technical' aspects (e.g. technological innovations, business models, management, policies and industrial systems) of the CE. This quadrant includes 32 articles in total. These studies either make explicit suggestions as to how to advance the CE transition or focus on the practical implementation of the CE through specific cases. One central theme of Quadrant I (instrumental/technical) is the *definitions and conceptualisations of the CE* in different contexts, often with an explicit practical focus. A clearer definition is deemed as an imperative for a successful CE transition. Such a definition should be capable of simultaneously traversing strategies, objectives, assessment methods and needs of future states and stakeholders [44], ranging from transformative business models [45] to public acceptance in developing countries [46]. Instrumental/technical research has also conceptualised the core aspects of 'circular cities'[4] [47] and opened the discussion for the adequate definition of broad and vague CE-related terms, such as downcycling, as a necessary step towards their quantification and standardisation [48].

As with several works that fall within all the other three Quadrants discussed in the next subsections, many studies in Quadrant I address aspects of *governance, particularly related to the CE transition*, with the ambiguities and challenges involved. These studies have, for example, examined the contribution of multiple governance forms towards implementing the CE at the local level together with the challenges they face [49–51], as well as how strategic urban planning can translate CE objectives into actions in urban areas despite existing barriers [52]. Others have explored the possibility of applying the Circular Economy Monitoring Framework (CEMF), an indicator-based framework developed by EU that aims to monitor national and EU level circularity performance, currently operating at national and international levels, as a means of measuring performance and progress in urban areas [53]. The governance of CE transitions has been also examined more broadly,

such as through the adoption of frameworks and policies that promote and enforce extended producer responsibility [54]; the evaluation and steps towards the adoption of blockchain technology for waste management at a global level [55]; as well as standards related to global waste flows as policy instruments for implementing the CE [56]. Research has also examined the implementation of the CE within the EU and associated potential barriers [57, 58], looked into the relationships between them, and sketched out possible strategies to overcome those barriers [59]. In their study, Fitch-Roy et al. also called for more radical actions in order to create policy conditions for sustainable consumption and production [60].

Another central theme in this quadrant is the *implementation of the CE* in certain industrial, (re)manufacturing and business contexts. Circular construction practices in the urban built environment appeared several times in our analysis, with works focusing, for example, on the emerging deconstruction sector [61] and the building industry, highlighting that the obstacles to its development can be directly associated with the lack of policy guidance [62], an insight explicitly connected to the theme of governance mentioned above. Further, the imperative of materials' reuse and recycling through cross-sectoral synergies between manufacturing and construction has also been examined [63]. Other studies focused on quite specific matters such as urban environmental sustainability indicators' ranking related to population density, infrastructural strategies and citizens' awareness [64], as well as more general ones, such as perspectives from emerging Global South settings with untapped circularity potential [65].

Besides construction and building, however, design and manufacturing solutions to materials such as packaging have been interrogated, adhering to the 'design out waste' principle and aiming at waste volume reduction [66]. It has also been stressed that implementing the CE can be a matter of learning from past practices in combination with industrial/technological advancements. The textile industry, for example, can employ waste protein sources as a circular material [67, 68]. Through a completely different approach, and drawing from evolutionary game theory and scenario building, a set of practical recommendations towards policymakers, local authorities and managerial personnel has been developed as a means of further boosting the already accelerating Chinese remanufacturing sector [69]. When the focus on CE implementation shifts to the business sector, changes in organisational perspectives together with reconceptualisations of value chains through innovative waste-to-resource models are called for [70, 71], often with the employment of specific, longitudinal case studies [72, 73]. Moreover, the implementation of the CE through start-up business practices [74] and different corporate contexts [75] has been scrutinised with a specific focus on institutional perspectives.

In this subsection, we have examined works that emphasise technical aspects of the CE and either make suggestions to enhance the CE transition or focus on the practical implementation of the CE through specific cases. Thematically, the studies in this quadrant have analysed the following issues:

- Different conceptualisations of the CE. Rather than critically examining, for example, the scientific or political underpinnings of the CE concept, articles in this quadrant often focus more on the practical implementation of the CE, such as developing concrete CE strategies and objectives.
- Issues related to governance, especially from the viewpoint of the practical implementation of the CE and its potential barriers on different levels (global, governmental or local).
- Implementation of the CE and the different conditions of this implementation in certain industrial or business contexts (e.g. building or packaging industries).

To sum up, the literature we have covered in this subsection has thereby a more or less instrumental knowledge interest. In the following subsection, we will examine work that focuses on the technical aspects of the CE from an analytical perspective.

Quadrant II: analytical/technical

In Quadrant II (analytical/technical), which includes 31 articles, we have placed studies which emphasise the technical, engineering, management and/or economic aspects of the CE, and in which the main objective is to develop an understanding of how the CE is set into motion, be it by reviewing existing literature or by way of conducting empirical work. We have also included studies that focus on topics like engineering from a managerial perspective that either employ social scientific research methods or somehow contribute to social scientific discussions and debates on the CE.

Similarly to the studies in the instrumental/technical quadrant, some studies positioned in Quadrant II, too, focus on the CE definitions and conceptualisations, but the latter also have as their explicit aim to formulate a *new definition of the CE*. One of the most widely circulated definitions for the CE to date is that offered by Kirchherr et al., who define it as follows:

> A circular economy describes an economic system that is based on business models which replace the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operating at the micro level (products,

> companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations. [30, pp. 224–5]

What is striking about the definition provided by Kirchherr et al. is its emphasis on business models as the basis of the CE. If it is accepted that the transition towards a CE requires a systemic change, sustainable development cannot be accomplished by merely renewing business models. This definition has also been criticised by Figge et al., who lament it for being too broad and that the criteria it provides are 'neither necessary nor sufficient' [34]. Desing et al. suggest their own definition based on current mainstream CE definitions, while others do this by drawing on interviews with CE experts or literature reviews [11, 76, 77]. What these articles have in common is that they regard existing CE definitions as inadequate and stress the need to take certain disregarded aspects, such as commonsense understandings [77], into account in the definition of the CE. These studies also criticise the lack of conceptual clarity of the CE, as it leaves the CE open to varying interpretations and uses [78], which enables different groups to use the concept to support their own interests.

However, it is also characteristic of some studies in this quadrant that they discuss the CE concept and the different CE approaches more generally rather than always aiming towards a new definition. In their article, Cecchin et al. highlight the similarities between the concepts of the CE and industrial ecology or industrial symbiosis[5] [79]. The authors show that 'the CE has become a dominant term in academic and policy discourse' [79, p. 84]. Nevertheless, others have attempted to situate historically the development of the CE concept through distinct phases [80]. Through a more critical gaze, and either by addressing the nature/society dichotomy [81]; or by employing biophysically-grounded approaches [82]; or by adopting *systems thinking*[6] [83], studies have examined how the *CE can challenge mainstream economics*. Apart from the studies focusing on the CE concept, and while the works positioned in this quadrant are not instrumentally oriented, *the facilitation of CE transitions* emerged here as an analytical theme as well. Addressing conceptual, methodological and technical/policy-related challenges and (quite often terminological) ambiguities have been the main motivations behind such problematisations [84–86].

The examination of *governance* aspects such as CE policies and strategies was also a central theme for the studies in this quadrant. While generic accounts providing an overview of basic policy developments are not missing [87, 88], works in this sub-category shed light on and add to the diversity of current CE policy shortcomings. It has been demonstrated, for example, that biodiversity protection is not often mentioned in CE theory and policy [89], while the ongoing need for more globally oriented and socially inclusive approaches has also been stressed [90]. A recurring topic that overlaps with studies situated within the instrumental/technical quadrant is the *critique* concerning the *ambiguity of terms* exemplified in CE policies and directives, especially the official terminology and conceptualisation when it comes to waste [91–93], its layered subcategories [94], and the regulatory distinction between waste and non-waste [95, 96]. The European Union's Waste Framework Directive appears as a crucial source for such analyses, with inquiries also calling for careful (re)consideration of property rights [97], as well as the normative exercise of control on marginal property practices in relation to waste [98]. As much as points for reconsideration of already existing policies and directives are proposed, Bauwens et al. approach the matter from the other end of the temporal spectrum and attempt to inform/inspire policy-makers and businesses through a speculative account on CE futures based on scenario-building [99].

Research in this quadrant has also problematised certain aspects of *CE strategies*. At the level of national governments, strategic approaches to achieve a CE showcase high variability, with some of these approaches revealing shortcomings in the CE strategies' capacity to generate real change [100]. For example, the 'waste-to-resource' paradigm can potentially lead to linear economic reinforcement through waste overproduction [101]. In line with this observation, studies have called for the early and careful consideration, detection and mitigation of rebound effects[7] [102, 103].

This subsection explored work that emphasises the technical aspects of the CE and in which the main objective is not to suggest practical implications to enhance the CE transition but rather to increase understanding of the CE and its various aspects. The main themes in this quadrant were:

- CE definitions, examined often with a specific aim to develop new definitions for the CE. Moreover, some studies also criticise existing CE definitions e.g. because of their lack of conceptual clarity.
- The CE concept discussed more broadly, for example by outlining the historical phases of the development of the concept.
- The facilitation of CE transitions, analysed e.g. through different factors that either hinder or facilitate transition.

- CE governance. Compared to the studies focusing on governance in Quadrant I, articles in Quadrant II do not focus so strongly on the practical implementation of the CE, but rather analyse different aspects of governance, such as the role given to biodiversity protection in CE policies.
- CE strategies, e.g. the problematisation of the capacity of CE strategies to create changes.

In the following section, we will move on to analysing work that attends to the social aspects of the CE and proposes explicit practical implications related to how to advance the CE transition or deal with certain practical examples of implementing the CE.

Quadrant III: instrumental/social

Articles in this category (39 papers in total) either propose practical applications towards transitioning to a CE or deal explicitly with practical cases (e.g. the implementation of the CE policies). Nevertheless, their overarching focus is on social aspects. Many articles in this quadrant have employed diverse case studies as examples of how the CE is (or could be) practically set in motion. Jacquot and Morelle have discussed the advantages of waste-to-resource national and transnational circularities when it comes to end-of-life vehicle (ELV) processing [104]. Employing the concept of planned obsolescence, Szto and Wilson have similarly argued that extended producer responsibility could have transformative effects towards a circular bike industry [105]. Further, Spekkink et al. have emphasised the role of civil society actors in contributing to the CE [106]. Stowell and Brigham, on the other hand, show 'how e-waste and value are assembled, extracted and circulated within local, national and global contexts' [107, p. 75]. Jumping from (e-waste) mining to (food) farming, Dagevos and de Lauwere examine the ways Dutch farmers understand, manage and operationalise CE in their businesses [108]. Lastly, the textiles-fashion-CE nexus has been examined through specific cases, from fish skin as an indigenous, centuries-old but promising practice of turning food waste into high fashion [109] to end-of-life fire hoses transformed into luxury handbags [110]; but also along aggregated quantitative lines stressing the imperative to transform the textile sector through the waste-to-resource paradigm [111].

One theme repeatedly appearing in works categorised within Quadrant III is the capacity of the CE to address issues of *equality, representation and inclusion.* The role of various vulnerable groups with the potential to foster social change has been examined in detail, including waste pickers [112, 113], refugees, disabled people, and migrants [114]. On some occasions, and viewing the CE as a means to promote social equity [115], scholars have tried to identify ways of delivering a more just, sustainable CE model [116] by equally considering social and livelihood repercussions [117, 118].

Researchers have also presented strategies to operationalise the circular society concept[8] and noted that even though academic research on the CE highlights economic and environmental aspects, its implementation relies on collaboration at the societal level [119–121]. It has also been highlighted that the CE discourse is highly optimistic; alternative circular visions have been proposed [122], thus challenging the dominant technocentric character of CE policies [123].

Several studies in this category have analysed *consumption* in the context of the CE. Compared to the articles focusing on consumption in Quadrant IV (analytical/social), those in Quadrant III focus more clearly on developing practical solutions to consumption-related problems [124–126]. Moreover, consumption studies within this quadrant have inquired into the drivers for green buying [127]; tourist practices' contribution towards sustaining the development of the CE [128]; the relation between unsustainable consumption and urban spatial forms through the example of mobile phone use [129]; and consumers' knowledge on mobile phone life cycle and its implications for potential changes in phone purchase and use behaviour [130].

Various CE *governance*-related aspects of both social and practical nature have been problematised within this quadrant as well, analysing for instance how circular food waste legislation is interpreted by key stakeholders [131]. Much work has also been conducted on circular cities and urban sustainability in relation to CE governance by examining the role of imaginaries [132], incremental versus rapid transformation [133], urban development [134] and civic engagement [135]. CE governance aspects have also been studied in specific national contexts to either promote alternative viewpoints to the dominant European and Chinese paradigms [136] or to advocate for the importance of synergies and pinpoint the inherent complexities of a CE transition [137, 138].

Scholars have also applied a posthumanist[9] and intersectional[10] perspective to study the circular policies of cities. Rask has explored certain municipal policies in which the CE is a key strategy and argued that further attention to power, equity, and justice can help in shaping CE approaches that focus more strongly on 'sufficiency and strong sustainability frames like degrowth and post-growth' [139, p. 1288]. Quite specific issues have been addressed as well, such as the role of cultural heritage buildings in European circular city plans [140]. Finally, and based on expert interviews, Marjamaa and Mäkelä have examined different alternative future images for the CE [141].

This sub-section put together scholarly works whose main focus is on social aspects and questions with an appetite, however, to propose hands-on courses of action towards addressing them. The main themes of the studies identified in this Instrumental/Social quadrant were:

- Practical implementation of the CE analysed through case studies, such as how extending producer responsibility in certain industry sectors could enhance the CE.
- Equality, representation and inclusion in the CE. These issues were addressed e.g. by highlighting the role of different vulnerable groups, such as waste pickers, in CE transitions.
- Consumption and consumer behaviour, e.g. consumers' attitudes towards circular practices.
- Governance, together with policy- and discourse-making, highlighting the social aspects of the CE, such as the role of citizens in circular cities.

In the next and final subsection, we will focus on studies that address the social dimensions of the CE through an analytical approach.

Quadrant IV: analytical/social

In this final subsection which includes a total of 59 articles, we clustered studies that attend to the social aspects of the CE while simultaneously providing grounds for reflection and rethinking, oftentimes through empirical analyses, rather than suggesting explicit practical recommendations to advance the transition to a CE. Many of these articles present a *critique of the CE definition, logic and policies*. As expected, much weight within this theme is attributed to the CE's associated social pillar, where considerably lower levels of engagement with matters of socio-ethical concern [142, 143] and cultural and political scrutiny [144] have been showcased.

Critically engaging with the current CE conception, some works have theorised an alternative, social economy-based embedding of circularity [145] and have placed human and societal needs at the centre of the CE narrative [146]. Others have argued that the depoliticised, ecological modernist and technologically mediated drivers of the CE downgrade the role of the citizen and have proposed post-capitalist alternatives open to experimentation [147]. The modernist logic of the CE, according to Isenhour et al., also prevents the realization that organic and inorganic entities are not separable, and therefore creates systems of artificial, unsafe and unjust boundaries [148]. Criticising the foundations of this same modernist logic pervading the CE model, Abrahamsson [149, p. 113] questions the attendant 'internal logic of waste management as resource creation', problematises the valuation rationale within the emerging food waste economy and warns that 'waste recycling also effectively short-circuits interventions that aim at reducing waste' [149, p. 114]. This valuation rationale is further questioned in relation to electronic waste and complicated by attending to what Beigi and Picard call waste (im)perceptibility: the condition whereby reality is framed through regimes of selective visibility when commercial aspects collide with associated concerns of risks, toxicity and magnitude in waste production [150].

A number of other works within the Analytical/Social quadrant have similarly emphasised the need to examine the *cultural, political and ethical dimensions* of the CE. The *technocratic and apolitical framing of the CE discourse* that draws from market-oriented capitalism has been critically examined [151], with calls towards an environmental politics of the CE [152] focusing on diversity instead of dependency [153, 154]. Attending also to how *social justice* emerges in the CE discourse [155], the idea of a *just transition* has been specifically scrutinised with a focus on who will benefit from the CE [156]. In line with matters of politics and representation, researchers have inquired into the CE within urban settings, with the 'circular city' affording multiple potential translations leading to depoliticization, polarization or transformation [157]. Even though constrained by neoliberal urbanism, the CE has been further argued to offer an alternative space for urban politics [158], with the social and *solidarity economy*[11] being viewed as a potential balancing framework towards strengthening the social and cultural aspects of the CE in the city [159].

Some studies have also stressed that the CE has been unable to address the challenges related to *consumption and consumers* and that the role of the consumer is depoliticised therein [147]. A literature review examining consumption in the context of the CE identified the focus on quality (and not quantity) of consumption as a significant drawback, while the lack of heterogeneity in methods and methodologies employed was criticised [160]. An additional review article tracking the state-of-the-art within the CE-consumption nexus argued for further research on the 'socio-material and cultural aspects of consumption in the context of the circular economy' [161, p. 1]. Regarding consumption work, scholars in this quadrant have highlighted the lack of systematic scrutiny within the CE literature [39]. Moreover, it has been argued that the everyday life of consumers entails complex requirements related to consumption: this complicates the accomplishment of CE goals through waste reduction practices [162] and requires more attention to the specificities of domestic waste work that reveal alternative modes of enacting the CE [163]. In line with attributing agency to the consumer, 'a shift from imagining consumers as "users" of particular products or services, to conceptualisation as

"doers" of everyday activities' [164, p. 1] has been proposed together with alternative consumption enactments [165, 166].

As within other quadrants, a recurring and diverse theme within Quadrant IV was related to *governance* aspects, though what was distinctive of the articles charted in this quadrant was that issues of governance were examined specifically in connection with *CE discourses, narratives and imaginaries*. For example, Gregson et al. demonstrate facets of the moral character of the CE model within the EU and argue that its drivers are 'discourses of ecological modernization, environmental justice and resource (in)security' [167, p. 218]. Holmes et al., on the other hand, broaden the field and propose alternative, more situated circularity framings by introducing matters of temporality and space (in more detail, 'temporal reconfiguration of material flows') [168]. When different national CE discourses and policies are compared, it has been argued that they are dominated by technocentric approaches and that social justice considerations 'for a fair distribution of the costs and benefits of a CE transition' are very limited [169, p. 1331]. Moreover, research on EU CE policies has showcased that the ecological modernisation-related discourse is still dominant, despite hopes for renewal through the advent of CE framings [170], and that the chosen indicators of the EU CE monitoring framework neglect dimensions related to systemic change [171].

At the planetary level, different CE discourses have been identified and grouped according to their degree of optimism and scepticism [172]. Analysis of the CE and degrowth imaginaries has shown that the potential of reducing waste in the context of the CE in the future depends on its ascribed value [173]. At the same time, a comparison of the CE and degrowth concepts has revealed common goals and principles [174]. Furthermore, the political dimensions of publicity creation in the CE context have been explored and it has been illustrated how certain agents, material circuits and CE policy visions can be emphasised over others [175].

Several studies in this category also focused on analysing the *materiality of waste* in the context of the CE. Utilising an ethnographic approach, researchers have explored the material practices of sharing and circulating food and clothes [176], studied the 'make-up' work of transforming biowaste into energy in biogas plants [177], and inquired into matters of care as an antidote against dominant narratives of 'scaling up' [178]. Ethnographic studies on the CE have also highlighted the difficulties of turning fluid biowaste matter into value [179], examined the practices of circulating and framing food products in supermarkets [180], and inquired into different potential CE futures in the making through everyday practices [181]. Others have highlighted how the CE discourse focuses on the actions of privileged groups and thus 'nobodies' informal CE actors and practices [182], with waste work being still regarded as exterior to capitalist production and 'otherised' through the formal-informal economy dichotomy [183–185]. The groundings of the CE are also showcased to be far from perfect when spatial/geographical aspects of remoteness and disconnectedness are considered, with island territories being a prominent example of waste accumulation and waste colonialism [186, 187].

Finally, there exists a rather diverse and heterogeneous mix of scholarly articles of a more holistic nature within the analytical/social quadrant that, through the combination of ethnographic methods and interdisciplinary theoretical conceptualisations, map and trace the situated, complex and contested realities of circular practices. These works engage with and cross-fertilise material aspects of circularity with broader everyday [188–190], worldly [191], ethical [166], commoning [192], multispecies [193] and political [194–196] considerations. The significance of these works' insights, together with the ones attending to the materiality of waste, will be discussed in more detail in the concluding section. Considered in relation to the rest of the themes identified in this quadrant (critique, culture/politics/ethics, governance, and consumption) and the three previous ones, they will be argued to offer several additional layers of much-needed, situated complexity to the CE literature.

As a result, the studies in this quadrant have been characterised by the appetite to critically engage with the CE's conceptual, ethical and political underpinnings. Even though practical solutions towards implementation were not proposed (as was the case in all previous three quadrants), what binds these works together is their advanced encompassing and ameliorative nature in terms of proposing alternative avenues for thinking, and therefore acting. Quadrant IV literature focused on the following themes:

- Critiques of the CE definition, logic and policies. These studies have, for example pointed out that current CE definitions do not sufficiently acknowledge the social aspects of the CE and stressed the need to study the cultural, political and ethical dimensions of the CE.
- The importance of taking consumption and consumers more into account in research focusing on the CE.
- Governance, especially from the viewpoint of CE discourses, narratives and imaginaries (e.g. by stressing that CE discourses are dominated by an ecomodernist or technocentric framework).
- The materiality of waste and situated, complex and contested realities of circular practices studied

through an ethnographic, interdisciplinary theoretical approach.

Conclusions

A successful CE transition fundamentally involves a societal change and a change in our everyday social practices and relations. It is therefore somewhat surprising and curious that heretofore social scientific approaches have received relatively little attention in the CE literature. In this article, we have taken the initiative to partly correct this bias by providing a review of Anglophone social scientific articles published on the CE. We reviewed a total of 161 sources and analysed them along two axes, with each axis having two main categories as their imaginary limits: instrumental-analytical and social-technical. Out of these two axes, four quadrants were formed: instrumental/technical (Quadrant I), analytical/technical (Quadrant II), instrumental/social (Quadrant III), and analytical/social (Quadrant IV). The distribution of the articles with respect to these quadrants was 20%, 19%, 24%, and 37% accordingly.

As most of the works did not neatly and self-evidently fit within one main category, we found the categorisation of the works along the two axes helpful, as it allowed us to situate and group the found sources in a spectral fashion across the four quadrants. What is more, several, often overlapping themes were identified within each quadrant. Starting from the theme of the implementation of the CE, works in any other quadrant did not focus as explicitly on it as works in Quadrant I did, although for example in Quadrants II and III there were numerous studies in which the facilitation of the CE transitions was identified as a closely related theme. Some themes appeared in several quadrants. Works within Quadrants I, II, and IV all addressed CE conceptualisations and definitions, albeit they did this differently: while articles within the first quadrant had an eye on the practical implementation of the CE, studies within the second one more often suggested new definitions for the CE and did not focus so strongly on how aspects of the concept itself could be practically implemented (some studies in Quadrant II also discussed the CE concept more generally). As for works plotted in Quadrant IV addressing the concept of the CE, this was often a topic subjected to critique due to the limitations inherent in its modernist logic [149] in addressing more-than-economic matters associated with ethics, politics and culture.

The theme of governance appeared in all four quadrants. It also partly overlapped with the theme of the implementation of the CE. Quadrant III was the only one which included works that extensively employ specific case studies to act as examples towards the actualisation of a generalised and normalised CE. These works, when it comes to the critical lens employed, could not be further from the ones addressing matters of equality, representation and inclusion within the same quadrant. While the former, as most works in Quadrant I, consider the CE as an applicable solution to the current global predicament, the latter employ an inherently reflective approach to consider avenues by which the CE could ameliorate its own 'internal' technocentric ills. Another overlapping theme was issues of consumption, addressed by articles plotted both in Quadrants III and IV. While the focus of the works within the third quadrant was more explicitly on the 'social' side than in Quadrants I and II, the majority of the articles plotted in Quadrant III that examined consumption and consumer behaviour nevertheless worked within the CE model rather than challenging it or critically reflecting on its potential shortcomings.

Our review found out that critical engagements with, and contestations of, the CE are still fairly rare in the research literature on the topic. As Gregson et al. note, the idea of the circular economy is 'more often celebrated than critically interrogated'; the use of the concept 'in both practitioner and academic literatures tends to be approbatory, uncritical, descriptive and deeply normative' [167]. The task of critically disclosing the flaws and shortcomings of the CE model was explicitly taken up by works plotted in Quadrant IV with an analytical/social anchoring. Consisting of 59 works, this quadrant was by far the most populous of the four (with 32 articles within Quadrant I, 31 within Quadrant II and 39 within Quadrant III accordingly). The key difference between the analytical/social works and the great majority of works grouped in the other three quadrants was the critical, reflective and ameliorative stance of the former. This stance was further evident—as with the works themed within equality, representation and inclusion in Quadrant III—in the literature problematising the cultural, political and ethical dimensions of the CE, unsurprisingly pointing at matters of de-politicisation, justice and solidarity.

Overall, given their focus on what we referred to as 'technical' aspects of the CE, articles placed within Quadrants I and II did not always break away that radically from the great majority of CE scholarship, which tends to emphasise technological innovations and business development such as redesigning products, services and industrial systems at the expense of the social aspects and underpinnings of the CE. Based on our review, it was especially the articles plotted in Quadrants III and IV, instrumental/social and analytical/social, that bring out more distinctively what the social sciences have to offer for the understanding of the CE.

As the studies in these last two quadrants have highlighted, a successful CE transition cannot be carried through only by developing new business models, technologies and governance strategies. The CE transition calls for a societal change that requires transforming socio-material practices and attending to matters of everyday life. Accordingly, scholarship has stressed that the transition thus necessitates not only a systemic [197] but also a micro-level change [198, 199]. Further, Nikolaou and Tsagarakis stress that the micro-meso-macro level approach is central in the CE literature [200]. Drawing from this triple-level approach, Merli, Preziosi and Acampora have shown CE research to follow three main lines of action, respectively: supporting firms in circular processes implementation at the micro level; discussing industrial symbiosis experiences at the meso level; and changing the social and economic dynamics at the macro and administrative level [29].

Importantly, and related to the above, detailed scholarship on micro-level practices and relations remains scarce to this day. Our review shows that there exists, for example, only a handful of ethnographic studies examining the enactment of the 'circularity' of materials in socio-material practices [see e.g. 176, 177, 178]. In addition, there is a very limited number of articles that problematise how circularity is made and contested in complex multispecies, everyday, political and ethical assemblages that often go unnoticed and remain at the backdrop of normative disciplinary categorisations [188–196]. The great majority of the studies in Quadrants III (35 out of a total of 39, i.e. 90%) and IV (37 out of a total of 59, i.e. 63%), as with *all* works in Quadrants I and II, focused on 'major' systemic processes and issues, such as CE discourses and policies (and seldom on their critique), social issues related to the CE (such as equity and labour rights), consumption and governance.

Besides following the customary path of grouping and categorising diverse and differential sources to render them intelligible, this review article has also showcased and paid attention to the aforementioned imbalance, whereby further reflection, critique and thick, detailed descriptions of the normalisation of the 'major' systemic CE processes usually remain marginal in the literary corpus. With this review, we call for the proliferation of such works and problematisations within the CE literature. It should be noted, however, that we do not wish to advocate for this proliferation in a dichotomous manner whereby concrete practices at local levels and scales would be examined separately from major processes operating globally. Such a claim would further limit the already restricted manner in which the different levels or scales of the CE have been understood, as the aforementioned triplet micro, meso, and macro attests. We are of the view that neither increased attention to mundane micro-practices and interactions nor embedding richly described local scales in a national or global system is enough to produce a balanced picture of the challenges and crucial planes of the CE transition. The scales that need to be aligned for a CE transition to come true are much more numerous than those of the micro, meso and macro. What would be needed, thus, is an approach that would problematise each of these scales—as much as the idea of the 'local' and the 'global'—as categorical givens.

Footnotes

[1]Some authors, however, trace the theoretical roots of the concept all the way to the late 18th century, to Thomas Malthus's work 'An Essay on the Principle of Population' published in 1798.

[2]The larger context for this review article is the WasteMatters (funded by the European Research Council) and DECAY (funded by the Research Council of Finland) projects that study waste and the circular economy from a social scientific perspective.

[3]By 3 Nov 2023, Hobson [39] had been cited 404 times, Korhonen et al. [11] 3363 times, and Korhonen et al. [12] 1322 times.

[4]The concept of 'circular cities' is defined by the authors as follows [47, pp. 6–7]: 'A circular city is based on closing, slowing and narrowing the resource loops as far as possible after the potential for conservation, efficiency improvements, resource sharing, servitization and virtualization has been exhausted, with remaining needs for fresh material and energy being covered as far as possible based on local production using renewable natural resources.'

[5]Industrial ecology studies material and energy flows through industrial systems with an aim to reduce their environmental impact, and industrial symbiosis is a subfield of industrial ecology which focuses on closing pre-consumer (e.g. industrial) loops [79].

[6]For further reading on systems thinking, see e.g. [201].

[7]Zink and Geyer assert that 'circular economy rebound occurs when increases in production or consumption efficiency are offset by increased levels of production and consumption' [202, p. 596].

[8]The concept of circular society means an umbrella concept that focuses on the critical ecological, social and political implications of the CE transition [203].

[9]For more discussion on posthumanist perspectives, see e.g. [204, 205].

[10]For more discussion on intersectional perspectives, see e.g. [206–208].

[11]Solidarity economy refers to economic perspectives that focus on fighting poverty, inequality, and unsustainable forms of production and consumption [159].

Abbreviation

CE Circular economy

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Data availability

No datasets were generated or analysed during the current study.

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