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Review

A typology of circular economy discourses: Navigating the diverse visions of a contested paradigm

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ABSTRACT

The circular economy (CE) has recently become a popular discourse especially in government and corporate sectors. Given the socio-ecological challenges of the Anthropocene, the concept of CE could indeed help the transition to a sustainable, just and resilient future. However, the actual definition, objectives and forms of implementation of the CE are still unclear, inconsistent, and contested. Different actors and sectors are thus articulating circular discourses which align with their interests, and which often do not sufficiently examine the ecological, social and political implications of circularity. In this context, this research asks how to better navigate and analyse the history, complexity and plurality of circularity discourses by conceptually differentiating them in a comprehensive discourse typology. To answer this question a critical literature review has been carried out, which first, examines and reflects on the core challenges, gaps and limitations of the CE concept. Second, this research develops a comprehensive timeline of circularity thinking, which identifies and conceptually classifies 72 different CE-related concepts from the Global North and South (such as Gandhian and steady-state economics, buen vivir, doughnut economics and degrowth). This leads to the development of a typology of circularity discourses, which classifies circularity visions according to their position on fundamental social, technological, political and ecological issues. This research thus seeks to provide a basis for a more inclusive and comprehensive discussion on the topic, which opens the imaginary regarding the many circular futures that can exist and allows for a cross-pollination of ideas, policy options, strategies, practices and solutions.

1. Introduction

The Circular Economy (CE) has become a "go-to concept" that has caught the attention of all sectors of society in the recent years, including academia, businesses, NGOs and governments (Lazarevic and Valve, 2017). Searching online for the "circular economy" concept in 2008 would only show 20,570 results, the same search now leads to over 5.74 million, thus surpassing the popularity of the many ideas that originated it, such as "industrial ecology" (1.01 million results), and "industrial symbiosis" (195,000), and the ideas that are directly related to it like "cradle to cradle" (3.14 million), "biomimicry" (2.47 million), and "performance economy" (224,000).[1]

Overall, the CE concept is viewed as a promising idea and ideal that has much to bring towards addressing challenges of the Anthropocene (Aurez et al., 2016; Geissdoerfer et al., 2017; Murray et al., 2017). By proposing a regenerative and restorative system of production and consumption, which closes the input and output cycles of the economy, the CE is expected to solve the problems of resource scarcity, biochemical flow disruption, and climate change, all while revitalizing local and regional economies (Batista et al., 2018; Delannoy, 2017; Stahel, 2010).

While those ideals are very appealing, the CE concept is still under construction and debate and it still faces many challenges and research gaps to fulfil its promises. Indeed, it is a relatively new concept that is just recently catching academic attention. While there were only 116 academic articles published on the topic from 2001 to 2008, this number has grown exponentially to over 4900.[2] Nevertheless, most of the CE discourse has actually been developed by actors in the government and private sectors, which have specific political and economic agendas, and have often used the CE as a narrative device for greenwashing (Ampe et al., 2019; Korhonen et al., 2018b; Nylén and Salminen, 2019; Van den Berghe and Vos, 2019). Public policy predates

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[1] Search conducted in www.google.com on the 11th of November 2019, using the advanced search option to search for all results before the 31st of December 2008.
[2] Based on SCOPUS search for "circular economy" (abstract, keyword, title) search conducted on the 11th of November 2019.

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most academic research, especially in China where the concept has been a national strategy as early as 2002 (McDowall et al., 2017; Qi et al., 2016). Overall, the CE discourse has been dominated by non-academic sectors, which are espousing many economic and environmental benefits from circular policies and business models (e.g. Ellen MacArthur Foundation, 2015; European Commission, 2015). However, these discourses have failed to build a systemic and holistic understanding of the social and sustainability implications of the CE (Millar et al., 2019; Moreau et al., 2017; Temesgen et al., 2019). Moreover, there is little discussion regarding the complex and controversial relationships between CE, energy, resources, biodiversity, entropy, and economic growth (Bruel et al., 2019; Cullen, 2017; Desing et al., 2020; Korhonen et al., 2018a).

Some authors argue that those conceptual limitations are not important for practitioners, which need further empirical research rather than theoretical discussions (Kirchherr and van Santen, 2019). Nevertheless, considering that the CE is still a relatively recent concept, there is still a strong necessity to build its theoretical foundations. Otherwise, the CE runs the risk of lacking systemic validity, critical social relevance and its claims and propositions might be unachievable on a relevant scale to effectively address the socio-ecological challenges of the 21st century. In this context, the CE concept could easily be discredited and disregarded as a new form of greenwashing or as an oxymoron, comparable to green growth or ecological modernization (Gregson et al., 2015; Lazarevic and Valve, 2017; Monsaingeon, 2017; Valenzuela and Böhm, 2017). This research aims to address such conceptual risks and help actors better navigate and analyse the history, complexity and plurality of circularity visions by establishing a typology of circularity discourses. Such a typology can provide a basis for a more inclusive and comprehensive discussion on the topic, which opens the imaginary regarding the many circular futures that can exist and allows for a cross-pollination of ideas, policy options, strategies, practices and solutions.

To establish a systematic and consistent typology we used several research questions as guidelines in our step-wise design process. First, what are the main challenges and shortcomings of the CE concept? Second, what are the historical origins and linkages of the CE with other concepts from the Global South and North alike? Third, what are the main conceptual differences and similarities of the core circularity discourses? By answering these three questions, this paper develops the first 2 × 2 typology of circularity discourses to date. While some papers do elaborate distinctions within CE thinking (see for example Blomsma, 2018; Blomsma and Brennan, 2017; D'Amato et al., 2019; Geissdoerfer et al., 2017; Homrich et al., 2018; Korhonen et al., 2018b; Kuzmina et al., 2019; Marin and De Meulder, 2018; Merli et al., 2018; Reike et al., 2018) no research proposes a systematic classification of circular discourses. This paper thus builds and expands on the work of those previous authors to fill this research gap and develops a discourse typology which contributes towards a better understanding and analysis of the CE and helps contextualize and navigate the plurality of the concept and its manifold possibilities.

Moreover, this research finds that the many related concepts which the CE historically builds on can positively contribute to its limitations through the cross-pollination of solutions and ideas. This is particularly important now that the concept faces a period of "validity challenge" (Blomsma and Brennan, 2017, p.609), and needs to address some of its major critiques and limitations to propose a compelling, fair, resilient and sustainable future. This paper thus not only fills a literature gap on CE discourse analysis[3] but also on the links between the CE and alternative social discourses and ideas (Bruel et al., 2019; D'Amato et al., 2019; Ghisellini et al., 2016; Moreau et al., 2017; Prieto-Sandoval et al., 2018; Schröder et al., 2019b; Temesgen et al., 2019).

The paper is structured as follows: first, it describes the research methods (Section 2). It then critically reviews the challenges of the CE concept (Section 3.1) and establishes a comprehensive historical timeline of circularity thinking (Section 3.2). The paper builds on these findings to differentiate circularity discourses based on the extent to which they address the identified challenges (Section 4.1). This is followed by the development of a new discourse typology, which classifies circularity discourses according to their position on fundamental socio-ecological issues (Section 4.2). Finally, a discussion Section 5 reflects on the conceptual and methodological implications of this research.

2. Methods

There are no standard methods for developing a discourse typology as previous researchers have followed a variety of different approaches (e.g. Audet, 2016; Dryzek, 2013; Schwarz and Thompson, 1990; van Egmond and de Vries, 2011). This paper was built based on a critical literature review,[4] which is particularly valuable to identify conceptual gaps in the literature and to develop new theoretical perspectives from a broad range of different fields and perspectives (Grant and Booth, 2009; Greenhalgh et al., 2018; Saunders and Rojon, 2011; Snyder, 2019).

In general, the main weakness of critical literature reviews is the inherent subjectivity in the selection of literature (Snyder, 2019). A systematic literature review could reduce this bias by having strict criteria for the selection of literature, which enables a detailed analysis of a specific topic (Grant and Booth, 2009). However, a systematic review does not allow for the effective integration of grey and academic literature, as well as academic literature in languages other than English, which are not effectively indexed in the main academic search engines such as Scopus and Web-of-Science (Albarillo, 2014; Morrison et al., 2012; Paez, 2017). Since this article aims to investigate the diversity of different circularity discourses, rather than developing an in-depth analysis of a specific aspect of the CE, a critical review is better suited to the objectives of this research as it can generally include a broader range of perspectives and theoretical positions (Greenhalgh et al., 2018; Snyder, 2019) .[5]

This paper was developed in four main steps, which build on each other and lead to the construction of the typology of circularity discourses presented in Section 4.2 (see Fig. 1).

The first step consists of a critical literature review of the CE and its challenges, gaps and limitations. This review does not focus on systematically or bibliometrically exploring what has been written on the CE, as many recent systematic literature reviews have already done so (see for example Blomsma and Brennan, 2017; Geissdoerfer et al., 2017; Ghisellini et al., 2016; Homrich et al., 2018; Kalmykova et al., 2018; Korhonen et al., 2018b; Kühl et al., 2019; Merli et al., 2018; Murray et al., 2017; Prieto-Sandoval et al., 2018; Reike et al., 2018). Instead, it focuses on critically analysing the conceptual challenges of the CE and why they are important to address. Literature was selected based on its relevance for answering the research question, publication date (with a specific focus on recent work) and importance (citation count, regardless of year). Moreover, to ensure breadth and diversity, literature from various fields was reviewed including industrial ecology (Bruel et al., 2019; Saavedra et al., 2018; Zink and Geyer, 2017),

[3] A Scopus search for "circular economy" AND "discourse analysis" (abstract, keyword, title), conducted on the 20th of December 2019, finds only 3 results.

[4] A critical literature review (also called integrative literature review) "aims to assess, critique, and synthesize the literature on a research topic in a way that enables new theoretical frameworks and perspectives to emerge […] This type of review often requires a more creative collection of data, as the purpose is usually not to cover all articles ever published on the topic but rather to combine perspectives and insights from different fields or research traditions." (Snyder, 2019, p.335-336)

[5] Reviewers have noted that a meta-synthesis method of literature review could overcome some of the limitations of a systematic literature, by adding expert consultations to search engine results to ensure a broad and diverse range of literature (see for example Kirchherr et al., 2016).

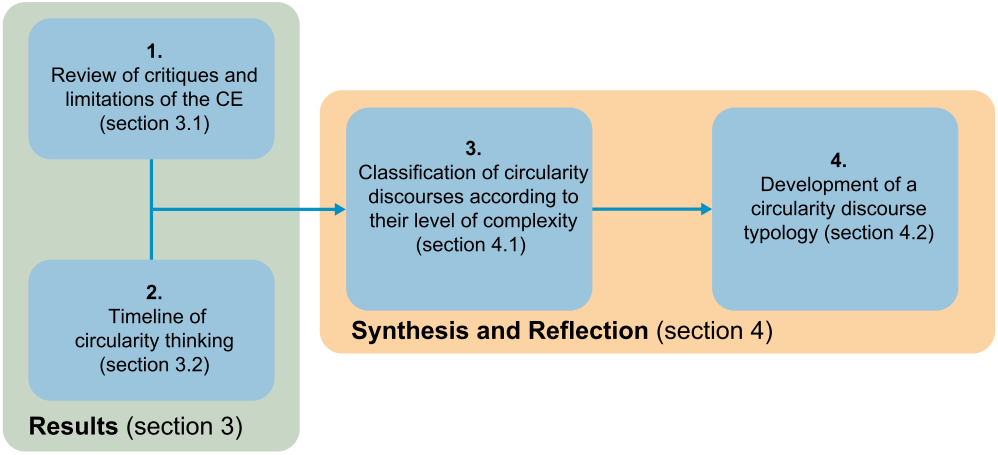

Fig. 1. Main steps in research methods.

ecological economics (Giampietro, 2019; Millar et al., 2019; Temesgen et al., 2019), environment and sustainability sciences (Korhonen et al., 2018a; Repo et al., 2018; Schröder et al., 2019a), resource efficiency (Lehmann et al., 2018), critical geography (Hobson and Lynch, 2016), engineering (Cullen, 2017), political ecology (Bihouix, 2014; Fressoz and Bonneuil, 2016), waste management (Velis, 2018), political sciences (Monsaingeon, 2017; Valenzuela and Böhm, 2017), business and management (Geisendorf and Pietrulla, 2018) etc. Search engines included Google Scholar, Scopus, and WorldCat: a total of 107 articles and books were thus reviewed (please see supplementary materials for full list).

In the second step, a timeline of circularity thinking was elaborated based on a broad perspective of CE as an umbrella concept (Homrich et al., 2018). The timeline builds on those previously developed by Blomsma and Brennan (2017) and Reike et al. (2018) and further adds to them to expand the debate on the CE. To elaborate the timeline, the results of the previous critical review were first carefully analysed, especially by examining what other ideas and theories were commonly connected to the CE. Snowball sampling (Handcock and Gile, 2011) was used to widen the focus to other similar sustainability discourses, especially focusing on the most influential work in the area. Books and articles from on closely related concepts were thus examined such as “permacircular economy” (Arnsperger and Bourg, 2017), “performance economy” (Stahel, 2010), “cradle to cradle” (McDonough and Braungart, 2002), “degrowth” (D'Alisa et al., 2014) etc. Conceptual diversity, plurality and breadth was sought by reviewing literature from the Global South and North alike as well as concepts from both practitioners and academics. A complete list of 72 different CE-related concepts was thus established. A key originating book or influential article was then reviewed for each concept to analyse its relation to circularity and to organise each idea in different historical and conceptual groups (Fig. 3).

The third step is a classification of circularity discourses according to their level of complexity (Table 1), meaning the extent which each discourse addresses the complex challenges identified in step 1. Five levels of complexity and a set of differentiating criteria for each level were thus established based on those challenges, which include issues of temporal and geographic scales, sustainability dimensions, and ontology. This allows for a clearer and more consistent distinction of the various concepts presented in the timeline (Table 2).

Finally, in the fourth step, a typology of circularity discourses was developed based on previous classifications of environmental discourses (Audet, 2016; Dryzek, 2013; Mann, 2018; Schwarz and Thompson, 1990; van Egmond and de Vries, 2011) and their adaptation to the particularities of the CE. The typology draws upon the findings of the previous steps by integrating the most important challenges identified in step 1 as well as the core criteria for the classification of circularity discourses (Table 1). Different 2 × 2 typologies were tested with each axis representing a core challenge identified in step 1 or a differentiating criterion developed in step 3. Different combinations were thus tried until a definitive version was established, which could effectively incorporate and differentiate all the circularity concepts presented in the timeline (Fig. 3). When conceptually defining each discourse type, the authors built on the results of previous research on the topic, in particular those, which have sketched other distinctions in circularity thinking (see for example Blomsma, 2018; Blomsma and Brennan, 2017; D'Amato et al., 2019; Geissdoerfer et al., 2017; Homrich et al., 2018; Korhonen et al., 2018b; Merli et al., 2018; Reike et al., 2018), and which have analysed circularity discourse in specific sectors (Colombo et al., 2019; Fratini et al., 2019; Kaźmierczyk, 2018; Kuzmina et al., 2019; Marin and De Meulder, 2018; Monsaingeon, 2017; Pardo and Schweitzer, 2018; Repo et al., 2018; Rijnhout et al., 2018; Valenzuela and Böhm, 2017; Vonk, 2018; Welch et al., 2017). The above steps ensured that the final typology would not be overly stereotypical or simplistic as it closely aligns both with previous research on discourse analysis and key debates on circularity. Moreover, earlier versions of the discourse typology were presented in an academic conference and three academic workshops to test and improve it.[6] These workshops involved around 15 to 25 academic participants and allowed for the discussion of the discourse typology and 4 circularity discourse types. They helped reduce inherent subjectivity in the construction of the discourse typology by collectively discussing the description of each discourse type and cross-checking their relation to the concepts in the timeline. Once the typology was finalized, it was used to classify the 72 concepts in the timeline (Fig. 3) as well as a list of 120 definitions of the CE[7] to evaluate where the current and past circularity debates stand.

[6] The conference was the 25th International Sustainable Development Research Society (ISDRS) Conference in Nanjing, China on the 27th of June 2019, 2 of the workshops were held at the Copernicus Institute of Sustainable Development, Utrecht University, in May 2019 and December 2019, and a third workshop with the CRESTING project research community in Lisbon, Portugal in September 2019.

[7] The set of definitions used are mainly those sampled by Kirchherr et al., 2017, which were supplemented with the addition of a few more recent definitions from (Geisendorf and Pietrulla, 2018; Gregson et al., 2015; Korhonen et al., 2018a, 2018b; Prieto-Sandoval et al., 2018). Please see supplementary materials for further details.

3. Results

3.1. Review of challenges and limitations of the circular economy

The major research gaps and critiques of the CE have been grouped into the 5 following topics, which will be examined in this section:

1 Systemic thinking on entropy, growth, capitalism and decoupling
2 The materials, energy and biodiversity nexus
3 Evaluating and assessing the full impacts of a circular economy
4 Governance, social justice, and cultural change
5 Alternative visions of circularity

3.1.1. Challenge 1: systemic thinking on entropy, growth, capitalism and decoupling

There is no agreed general economic or social theory underlying the CE. It is a useful concept for organizing regenerative and restorative production and consumption systems, but it is not based on any economic model or philosophical theory (Velis, 2018). While this makes the concept simpler and easier to promote and adopt, it also means that it faces key challenges, inconsistencies, and limitations in its understanding, application and its systemic validity (Geissdoerfer et al., 2017; Korhonen et al., 2018b; Lazarevic and Valve, 2017; Reike et al., 2018).

For instance, there is little clarity regarding entropy and the laws of thermodynamics as applied to a CE (Mayumi and Giampietro, 2019; Rammelt and Crisp, 2014). Since materials degrade in quantity and quality each time they are cycled or used, they cannot be circulated indefinitely (Korhonen et al., 2018a; Reuter et al., 2019). This means that to establish a perfect CE, where all resource inputs come from recovered or renewable materials, a general reduction in material demand, and economic throughput is necessary (Giampietro, 2019; Korhonen et al., 2018a).

Due to the immense challenges and limitations of recycling and recovery activities, a fully CE might be just as illusory as a "perpetual motion machine" (Cullen, 2017). Even if a perfect circularity of materials flows were possible, this would require a capping global resource use at a certain sustainable level, so the economy can run only on recovered and renewable resources. Yet considering the large unmet needs of over 45% of the global population which remains in poverty worldwide[8] (World Bank, 2019), capping material resource use has critical geopolitical dimensions and necessitates an essential reconsideration of normative questions regarding global justice, well-being and world-wide wealth redistribution (Arnsperger and Bourg, 2017; Bengtsson et al., 2018; Schröder et al., 2019a).

Furthermore, there is insufficient investigation on whether and how the CE could lead to an absolute, global decoupling of economic growth from environmental degradation (Antikainen et al., 2018). The question of growth is perhaps the largest *elephant in the room* for the CE. While proponents in the public and private sector argue that a CE would lead to over 600 billion euros in yearly economic gains for Europe alone (Ellen MacArthur Foundation, 2015), this relationship is very unclear (Korhonen et al., 2018a). Due to the inevitability of entropy and the inexistent evidence of absolute decoupling, there is no reason to think that a CE can operate in a context of continued economic growth (Hickel and Kallis, 2019; Jackson, 2016; Mayumi and Giampietro, 2019; Parrique et al., 2019; Ward et al., 2016). As capitalism cannot operate in a context of degrowth, this would mean that a fully CE is also inherently incompatible with the current productivist economic system[9] (Arnsperger and Bourg, 2017; Audier, 2019; Kallis et al., 2018; Latouche, 2009).

3.1.2. Challenge 2: the materials, energy and biodiversity nexus

The relationship between materials, energy, biodiversity, and circularity is a critical area that needs further research. Tackling climate change, biodiversity loss and resource scarcity indeed involves many complex trade-offs and synergies (Bleischwitz and Miedzinski, 2018).

Energy plays a key role in the cycling of material flows as it is needed to recycle, repair, refurbish or remanufacture any product or material (Cullen, 2017). Wastes (such as end-of-life tyres, biofuel pellets, food waste, and wastewater) can also play a key role in energy provision (through energy-from-waste operations) and by doing so, they reduce dependence from fossil fuels (Lehmann, 2018). However, energy recovery competes with higher value recovery options (such as recycling, composting or refurbishing) and generates significant greenhouse gas emissions (Bihouix, 2014). A mismanaged CE transition could thus lead to an increase in energy demand and greenhouse gas emissions (Monsaingeon, 2017).

Furthermore, transitioning to fully renewable energy grid will require a large amount of material resources to build the new infrastructure such as wind turbines, solar panels, smart grids, electric cars, trains and buses etc. (Moreau et al., 2019; Nieto et al., 2019; Reuter et al., 2019). This will inevitably increase demand for material resources, many of which could become inaccessible in less than 80 years, especially cobalt, lithium and nickel (Aurez et al., 2016; Fressoz and Bonneuil, 2016; Suh et al., 2017). Yet, these scarce critical raw materials used for renewable energy currently have very low recycling rates so various CE strategies are needed to prevent material shortages, such as refurbishing, recycling, lifetime extension and consumption reduction (Bengtsson et al., 2018; Bihouix, 2014; Lapko et al., 2019; Monsaingeon, 2017).

On the other hand, it is also worth noting that the CE could be an avenue for energy saving for some material resource flows as many secondary materials (mainly metals) can be obtained at much lower energy costs compared to virgin ones (Aurez et al., 2016). Moreover, improving waste management and eliminating landfilling can lead to lower methane emissions, thus contributing to climate change mitigation (Hawken, 2017; Jurgilevich et al., 2016). The interactions between CE, energy, climate change and material resources are henceforth complex and need further research to build sustainable pathways towards zero-carbon circular economies (Bleischwitz and Miedzinski, 2018).

The third dimension to the abovementioned resource nexus between materials and energy is biodiversity.[10] A zero-carbon CE can lead to increased demand for natural resources such as wood, bio-fuels, biopolymers, natural fibres, and land for wind, solar and tidal energy (Heck et al., 2018; Suh et al., 2017). This is especially the case if biotechnology, biomaterials and bio-based energy play a central role in a decarbonized "circular bioeconomy" (OECD, 2018). It is thus essential to balance an increased demand for natural resources and renewable energy with efforts in biodiversity conservation and restoration to maintain the biophysical health of the planet and the ecosystem services on which life depends (von Weizsäcker and Wijkman, 2017). There is a generally recognized planetary boundary that identifies the need to conserve at least 75% of the earth's natural ecosystems

[8] Figure for 2015 considering a World Bank global aggregation measure that uses 2011 PPP and $5,50/day poverty line (World Bank, 2019).

[9] Productivism is as system based on ever-expanding productivity and economic growth as the main purpose of human organization, it includes capitalism but also state communism as implemented in the USSR (Audier, 2019).

[10] It is worth noting that many other resource nexus perspectives exist. The academic literature typically speaks of a water, food, energy nexus (Del Borghi *et al.*, 2020), a water, food, energy, land and materials nexus (Bleischwitz and Miedzinski, 2018) and more recently an urban nexus of "food, water, energy and waste treatment systems" (S. Lehmann, 2018, p47) . Here a new nexus approach is formulated based on the interactions, synergies and interrelations which are most relevant for a circular society.

(Steffen et al., 2015). Currently, only 62% of natural ecosystems remain and the transition to a circular and zero-carbon economy could further worsen this situation, especially if the complex interactions between energy, biodiversity and material resources are not adequately dealt with (Bihouix, 2014; Heck et al., 2018; Raworth, 2017).

Moreover, biodiversity provides with key solutions to global problems by reducing soil erosion, improving human health, contributing to climate change adaptation (through ecosystem-based disaster risk reduction strategies), climate change mitigation (through carbon sequestration), improving water quality and quantity (through watershed conservation and restoration), improving soil health (through regenerative agriculture), reducing air pollution (through urban greening), improving waste-water treatment (through constructed wetlands), and inspiring human creativity and innovation (Benyus, 1998; Delannoy, 2017). These nature-based solutions must thus be better integrated with regenerative and restorative CE practices (Del Borghi et al., 2020; Jurgilevich et al., 2016; Reynaud et al., 2019). Moreover, a CE can also lead to reduced demand for goods through longer use-rates, reuse, repair, recycling, and refurbishing strategies as well as simple-living behaviours, all of which can significantly reduce environmental pressures (Bengtsson et al., 2018; Jackson, 2016; ;). The interactions between energy, biodiversity and material resources are graphically represented in Fig. 2.

3.1.3. Challenge 3: evaluating and assessing the full impacts of a circular economy

Holistically assessing and evaluating the sustainability impacts of circular systems is another large challenge. Research has found that many production systems that define themselves as circular can lead to greater environmental impacts than their linear counterparts (such as biofuels and biopolymers) (Hobson and Lynch, 2016; Monsaingeon, 2017; Velis, 2018; Zink and Geyer, 2017). Moreover, a CE approach that focuses on eco-efficiency creates a rebound effect, where reduced costs for one product or service leads to increased demand for it, while also creating saving that incentivize consumption in other areas (Zink and Geyer, 2017). Thus, efficiency gains lead to higher levels of overall resource consumption in the economy (Junnila et al., 2018). This is known as the Jevon's paradox and it has key implications in the realization of a CE that does not end up causing more negative than positive impacts (Kjaer et al., 2019). Even some product-service systems (PSS), which promote the access to products and services (as opposed to ownership), have had limited environmental benefits due to the abovementioned rebound effect (Hobson and Lynch, 2016; Junnila et al., 2018; Kjaer et al., 2019).

The development of clear indicators and assessment mechanisms to measure circularity, while accounting for this rebound effect, is thus a complex issue that needs to be resolved to ensure that circularity claims actually lead to ecological benefits (Antikainen et al., 2018; Corona et al., 2019; Manninen et al., 2018). While some CE impact studies exist in China and Northern Europe, more research is needed to fully understand the outcomes of circular projects and solutions (Kalmykova et al., 2018; Saavedra et al., 2018; Winans et al., 2017) and especially for result-orientated PSS, which could have a high sustainability potential if they are well designed and implemented (Kühl et al., 2019).

The ecological footprint indicator might be a useful tool in this regard, as it allows the measurement of the overall impacts of human activities, beyond punctual eco-efficiency improvements (Junnila et al., 2018; Kaźmierczyk, 2018; Rijnhout et al., 2018). The better integration of circularity and footprint indicators is thus key to ensure circularity interventions actually reduce the pressure on the Earth's biophysical limits (Arnsperger and Bourg, 2017; Bruel et al., 2019; Temesgen et al., 2019).

3.1.4. Challenge 4: governance, social justice, and cultural change

Another important challenge, which is often under-addressed in the CE literature to date, is the social dimension, especially with regards to issues of governance, justice, and cultural change (Geissdoerfer et al., 2017; Hobson, 2019; Korhonen et al., 2018a; Millar et al., 2019; Moreau et al., 2017; Schröder et al., 2019a; Temesgen et al., 2019). A Scopus search reveals that less than 17% of articles on the CE are from social science and humanities (of a total of 4901 articles on the CE:

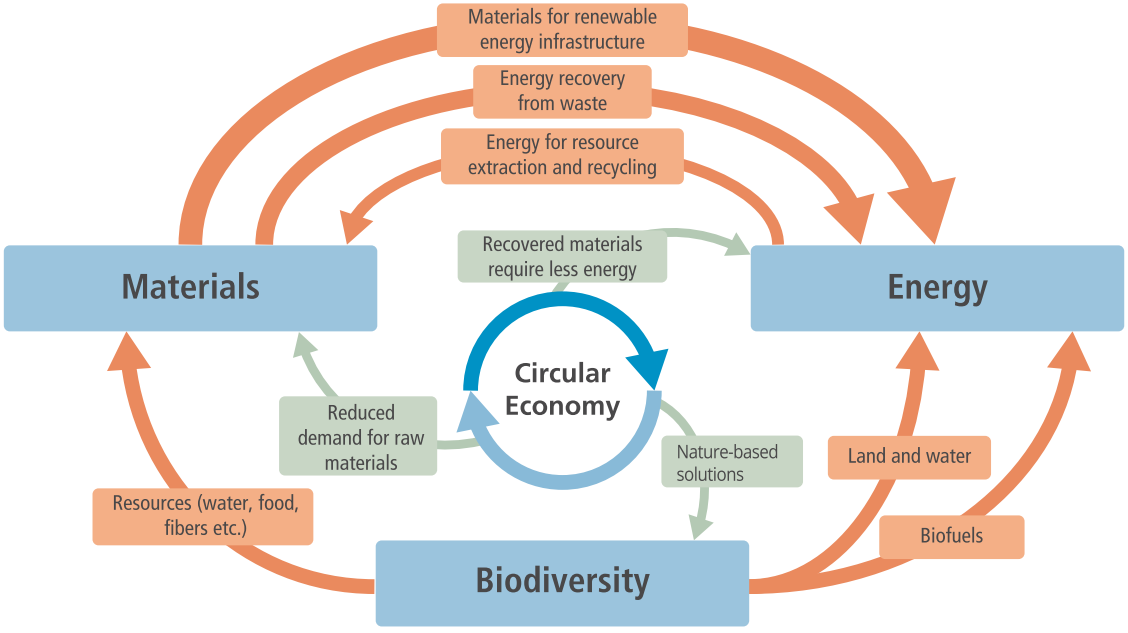

Fig. 2. Interactions of the Energy, Materials, Biodiversity Nexus (synergies are marked in green arrows, interactions with possible trade-offs are marked with red arrows). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

2316 are in environmental sciences, 1753 are in engineering, 1191 are in energy sciences, and only 804 are in social sciences or humanities).[11] By overlooking social considerations, CE research is proposing a technological path to sustainability that many have criticized for being overly optimistic regarding the speed of technological transitions and the capacity of society to integrate disruptive innovations, which challenge vested interests (Bihouix, 2014; Feola, 2019a; Fressoz and Bonneuil, 2016; Jackson, 2016; Latouche, 2009).

This approach also fails to recognize the massive socio-cultural change that a CE entails by transforming consumption and production structures based on materialism, convenience, and ownership to ones based on collaborative consumption, sharing economies and use-value (Frenken, 2017; Hobson, 2019; Lazarevic and Valve, 2017; Pomponi and Moncaster, 2017). When some of those social and cultural topics are addressed in the literature, it is dominantly done through commercial approaches, such as new business models for the private sector rather than from the perspective of a transformative social and solidarity economy (with some notable exceptions such as Baruque-Ramos et al., 2017; Chaves Ávila and Monzón Campos, 2018; Gutberlet et al., 2017; Hobson and Lynch, 2016; Moreau et al., 2017; Schröder et al., 2019a). Yet this is a key topic as evidenced by the work of Kirchherr et al. (2018) which found that practitioners see cultural barriers as the main barriers to a CE transition.

Moreover, there is a general lack of discussion regarding social and environmental justice aspects related to the CE. In a review of 114 definitions, Kirchherr et al. (2017) found that only 18–20% include social equity considerations. Critical questions regarding, who controls CE technologies and patents, and how the economic costs and benefits should be distributed both within and between countries, have thus received very little attention. Those are nonetheless vitally important questions that will determine whether the CE will lead to more meaningful jobs, closer communities, greater social equity and global solidarity or rather to increased precarity, inequality, and neo-colonialism (Arnsperger and Bourg, 2017; Bihouix, 2014; Schröder et al., 2019a). All in all, the CE could become a profitable industry owned by a few corporations in a handful of countries rather than a transformative movement that benefits all of humankind (Monsaingeon, 2017).

In his latest book, Thomas Piketty proposes a CE that circulates property and capital to redistribute resources and counter capitalism's inherent accumulative tendencies (Piketty, 2019). Further discussion on this form of CE is necessary to foster a circularity transition that is socially, economically and ecologically sustainable.

The governance and political considerations of a CE also deserve greater attention and study. Power plays a key role in the future of a zero-carbon CE transition as it determines who controls the discourse, who takes decisions and who will benefit from them (Hobson and Lynch, 2016; Lazarevic and Valve, 2017; Schröder et al., 2018). This is why it is key to establish a democratic and deliberative governance system for a CE to ensure that everyone is involved in its construction and that its benefits reach the most vulnerable. Yet, those political considerations are rarely taken into account by the literature on CE, which has mostly dealt with design, technological, managerial or business-led solutions (as evidenced by Fratini et al., 2019; Millar et al., 2019; Moreau et al., 2017). The Gilet Jaune movement illustrates the risks with a sustainability transition that does not sufficiently include political and social justice elements (Deléage, 2019; Laurent, 2019).

3.1.5. Challenge 5: alternative visions of circularity

There is limited research on alternative approaches to circularity such as degrowth (Kallis et al., 2018), steady-state (Daly, 1977), and simple living/voluntary simplicity (Alexander, 2015) concepts, which have a rich academic literature and share the same objective regarding the necessity to transform towards regenerative socio-economic structures which are compatible within the earth's system boundaries. Academics have indeed found core synergies between these concepts; especially literature on degrowth, which could complement the CE's lack of social dimension and system-wide thinking on entropy and biophysical limits (D'Amato et al., 2019; Ghisellini et al., 2016; Hobson and Lynch, 2016; Schröder et al., 2019b). Degrowth and simple living scholars also help conceive of circularity through a lens of sufficiency, conviviality, and social justice rather than being overly focused on technological innovation and eco-efficiency (Alexander, 2015; Caillé, 2015; Kothari et al., 2019). This sufficiency approach has recently gained some support in the CE literature as it can lead to a slowing of resource loops, with significant sustainability benefits (Bengtsson et al., 2018; Bruel et al., 2019; Hayward and Roy, 2019; Hobson and Lynch, 2016; Schröder et al., 2019b). Yet a recent review of 327 academic articles on the CE found that less than 10% of articles include this approach (Homrich et al., 2018).

There is also little work on indigenous discourses on circularity and alternative concepts from the Global South such as “ubuntu” (Shumba, 2011), “ecological swaraj” (Kothari et al., 2014), “buen vivir”/“suma qamaña” (Calisto Friant and Langmore, 2015) and the “Buddhist middle path” (Rinzin, 2006), which also share the goal of building regenerative systems that respect, sustain and restore the natural cycles of the earth. After all, circularity, in traditional hunter-gatherer, agricultural and pastoral societies, has existed for much of humankind's presence on planet earth and still exists in many parts of the world today (Giampietro, 2019). This has yet to be recognized by the literature, which is hence missing the opportunity to build key synergies and learn from radically different epistemological and ontological frameworks. Moreover, indigenous discourses often have the added value of being radically pluralistic and ecocentric as opposed to the anthropocentrism and ethnocentrism of most western environmental discourses (Kothari et al., 2019). They thus open up entirely new forms of conceiving democracy, waste, well-being, society and nature (Calisto Friant and Langmore, 2015; D'Alisa et al., 2014; Kothari et al., 2019).

Buddhism, Taoism and Confucianism also have strong ecological components, which have not been sufficiently related to the CE (Subramanian et al., 2018). Confucianism and Taoism played a key role in the early adoption of the CE in China as part of the creation of a “harmonious society” and an “ecological civilization” (Jin, 2008; Naustdalslid, 2014). Japan has also been implementing circular policies since the early 2000s through its innovative “Fundamental Plan for Establishing a Sound Material-Cycle Society” (Hara and Yabar, 2012; Hotta, 2011; Takahashi, 2020) and more recently with the “regional circular and ecological sphere” policy, which addresses key territorial and socio-ecological synergies (Japanese Ministry of the Environment, 2018). The Buddhist inspired Gross National Happiness Index (GNI) of Bhutan also deserves greater attention as it shows how new metrics that go beyond the Gross Domestic Product (GDP) can be developed and adapted to include key circularity criteria (Rinzin et al., 2007; Verma, 2017). Yet, more remains to be written on the philosophical components of a CE and how they can relate to different worldviews.

Overall, the research on degrowth and non-western visions of sustainability could bring key insights in the first and most important “loops” in the CE value-retention hierarchy: refuse, reduce, reuse and repair (Reike et al., 2018), all of which can lead to the sustainable slowing of resource cycles (Homrich et al., 2018).

3.2. Timeline of circularity thinking

A timeline of the CE thinking and its related concepts, based on a broad understanding of the EC as an umbrella concept (Homrich et al., 2018), is presented in Fig. 3. The timeline builds on the categorizations proposed by Reike et al. (2018) and by Blomsma and Brennan (2017), which were expanded to include a plurality of concepts from western and non-western perspectives alike. Fig. 3 thus allows to better situate the concept, both in its rich historical origins and in its complex theoretical diversity. This helps illustrate the manifold conceptualizations of

[11] Based on a Scopus search for “circular economy” (abstract, keyword, title) conducted on the 11th of November 2019.

	Circularity 1.0 and 2.0: Techno-fixes to waste		Circularity 3.0: Integrated socio-economic approaches to resources, consumption and waste		
Precursors to circularity	Circularity 1.0: Dealing with Waste	Circularity 2.0: Connecting Input and Output in Strategies for Eco-Efficiency	Circularity 3.1 Reformist views on the Circularity	Circularity 3.2 Transformational views of Circularity and visions of the Global South	
Preamble Period		Excitement Period		Validity Challenge Period	
1945-1980		**1980–2010**		**2010-present**	
Gandhian economics (Kumarappa, 1945)	Waste-Water Treatment (Holcomb,1970)	Industrial Ecology (Frosch and Gallopoulos, 1989)	**First holistic Circularity frameworks**	**New holistic Circularity views**	**Transformational views of Circularity**	**Non-western visions of Circularity**
The Economics of the Coming Spaceship Earth (Boulding, 1966)	Solid Waste Management and Recycling (Levick and Davies, 1975)	Circular Economy (Pearce and Turner, 1989)	Rio Declaration on Environment and Development (UN, 1992)	Blue Economy (Pauli, 2010)	Transition Movement (Hopkins, 2008)	Buen Vivir/ Sumark Kawsay (Government of Ecuador, 2008)
The tragedy of the Commons (Hardin, 1968)	Bio-Digestion (Hughes, 1975)	Eco-design /Design for environment (Ryan *et al.*, 1992)	Regenerative design (Lyle, 1994)	Material Efficiency (Allwood *et al.*, 2011)	Degrowth (Latouche, 2009)	Ubuntu (Shumba, 2011)
The Population Bomb (Ehrlich, 1968)	Energy Recovery (Boyle, 1977)	Cyclic Economy (Tibbs, 1993)	Natural Capitalism (Hawken *et al.*, 1999)	Third Industrial Revolution (Rifkin, 2013)	Eco-socialism (Löwy, 2011)	Ecological Civilization (Zhang *et al.*, 2011)
The entropy law and the economic process (Georgescu-Roegen, 1971)		Industrial Metabolism (Ayres and Simonis, 1994)	Sound Material-Cycle Society (Government of Japan, 2000)	Eco-system Economy (Scharmer and Kaufer, 2013)	Laudato Si' (Pope Francis, 2015)	Ecological Swaraj (Kothari et al., 2014)
The Closing Circle (Commoner, 1971)		Cleaner Production (Baas, 1995)	Cyclical Economy (Young *et al.*, 2001)	Regenerative Capitalism (Fullerton, 2015)	Transition design (Irwin, 2015)	Suma Qamaña / Vivir Bien (Artaraz and Calestani, 2015)
Social Ecology (Bookchin, 1971)		Reverse Logistics (Rogers and Tibben-Lembke,1998)	Materials Matter (Geiser, 2001)	Sharing Economy (Frenken, 2017)	Economy for the Common Good (Felber, 2015)	Buddhist, Confucian and Taoist ecology (Arler, 2018)
Limits to Growth (Meadows et al., 1972)		Eco-industrial parks and networks (Côté and Cohen-Rosenthal, 1998)	Cradle to Cradle (McDonough and Braungart, 2002)	Doughnut Economics (Raworth, 2017)	Post-growth (Jackson, 2016)	Radical Pluralism / Pluriverse (Kothari *et al.*, 2019)
Ecological Design (Papanek, 1972)		Biomimicry (Benyus, 1998)	The Natural Step (Robert, 2002)	Symbiotic Economy (Delannoy, 2017)	Permacircular Economy (Bourg, 2018)	
Small is Beautiful (Schumacher, 1973)		Product Service System (Goedkoop et al., 1999)	Performance Economy (Stahel, 2010)	Social Circular Economy (Social Circular Economy, 2017)	Voluntary Simplicity (Trainer and Alexander, 2019)	
Conviviality (Illich, 1973)		Extended Producer Responsibility (Lindhqvist, 2000)		Spiral Economy (Ashby *et al.*, 2019)	Convivalism (Caillé, 2019)	
Steady-state economics (Daly, 1977)		Industrial Symbiosis (Chertow, 2000)		Coviability (Barrière et al., 2019)		
Permaculture (Mollison and Holmgren, 1978)		Closed-loop Supply Chain (Guide et al., 2003)				
Décroissance (Gorz, 1980, first published in French in 1975)		Biobased Economy / Bioeconomy (OECD, 2004)				
Deep Ecology (Næss and Rothernberg 1989, based on 1976 book in Norwegian)		The Biosphere Rules (Unruh, 2008)				
Overshoot (Catton 1980)						

Fig. 3. Timeline of Circularity Concepts and Ideas (please see supplementary material for details).[17]

circularity as well as the reformist vs transformational circularity schools of thought, which shape the current debate on the topic (Reike et al., 2018). The 72 concepts in this timeline are further analysed in Sections 4.1 and 4.2 to classify them based on their key socio-ecological considerations and to examine how they address the complex challenges that the CE concept is presently facing.

The first period is a preamble stage (1945 to 1980), where discussions regarding resource limits and the ecological impacts of human activities became widespread thanks to key publications such as "The Tragedy of the Commons" (Hardin, 1968), "the Limits to Growth" (Meadows et al., 1972), and "Overshoot" (Catton, 1980). This phase is also ripe with a diversity of transformative proposals from various perspectives including Gandhian economics (Kumarappa, 1945), Buddhist economics (Schumacher, 1973), socialism (Commoner, 1971), anarchism (Illich, 1973), ecological economics (Daly, 1977; Georgescu-Roegen, 1971), political ecology (Gorz, 1980), and eco-design (Papanek, 1972). During this time, Boulding (1966) wrote "The Economics of the Coming Spaceship Earth", which is often considered to be the first reference to a CE-like system (Antikainen et al., 2018; Geissdoerfer et al., 2017; Murray et al., 2017; Prieto-Sandoval et al., 2018; Winans et al., 2017). He calls for a "spaceman economy", where "all outputs from consumption would constantly be recycled to become inputs for production" (Boulding, 1966, p5). These concepts had a strong understanding of planetary limits and gave a great attention to all the issues discussed in Section 3.1, including decoupling (challenge 1), resource trade-offs (challenge 2), rebound effects (challenge 3), social justice (challenge 4) and alternative visions of sufficiency (challenge 5).

During this preamble stage, a body of technical literature on waste management was also developed, which represents Circularity 1.0 approaches that deal with waste as a problem to be managed through end-of-pipe technologies (Reike et al., 2018). This is thus when the first waste management and recycling systems were developed for various waste streams (Reike et al., 2018; Takahashi, 2020). These concepts were mostly focused on specific technological innovations and thus didn't address the main challenges evidenced in Section 3.1.

Circularity 2.0, represents the beginning of an "excitement period" (1980–2010) (Blomsma and Brennan, 2017, p608), where a diversity of innovative ideas start to see waste as a valuable input for other processes (Reike et al., 2018). It is the time when the concept of a CE was first coined by Pearce and Turner (1989) and when many related ideas, policies, and business models emerged, including "industrial ecology" (Frosch and Gallopoulos, 1989), "industrial symbiosis" (Chertow, 2000), "product-service system" (Goedkoop et al., 1999), "reverse logistics" (Rogers and Tibben-Lembke, 1998), and "extended producer responsibility" (Lindhqvist, 2000). These ideas often take inspiration from nature to build new technologies and innovations that connect the output and input sides of the economy and make industries work like natural ecosystems. Since this period coincides with the growth of neoliberalism, most of these ideas were established and implemented through market-driven approaches and public-private partnerships (Monsaingeon, 2017) which didn't give much attention to the main challenges discussed in Section 3.1, except for challenge 2 on the resource nexus.

With Circularity 3.0 (1990-present) the beginning of a comprehensive socio-economic approach to waste, resources, production and consumption emerged; which often builds on the objectives of the Rio Declaration on Environment and Development (UN, 1992). During this period the original CE concept was further developed by new ideas including "the natural step" (Robèrt, 2002), "the performance economy" (Stahel, 2010), "cradle to cradle" (McDonough and Braungart, 2002), and "natural capitalism" (Hawken et al., 1999). However, from about 2010 onwards, it is also a "validity challenge period" (Blomsma and Brennan, 2017, p.609), where many inconsistencies and conceptual challenges of the CE must be resolved. From this point, the concept can either cohere, by resolving its theoretical challenges, collapse, as inconsistencies become insurmountable, or persist as a contention, as different positions end up "agreeing to disagree" (Blomsma and Brennan, 2017, p.609).

In this critical moment, two broad movements of the CE concept can be seen: first, Circularity 3.1, which represents reformist discourses that operate within the boundaries of the capitalist system (e.g., Allwood et al., 2011; Fullerton, 2015; Pauli, 2010; Rifkin, 2013), and second, Circularity 3.2, which represents transformational discourses seeking wholesale transformation of the socio-economic order (e.g., Arnsperger and Bourg, 2017; Kothari et al., 2014; Latouche, 2018; Trainer and Alexander, 2019). Both discourse types include issues of planetary boundaries, the rebound effect, social justice, and good governance (as discussed in challenges 2, 3 and 4), however, they vary in their views regarding the capacity of capitalism to overcome resource limits and decouple ecological degradation from economic growth (as evidenced in challenge 1) as well as topics of epistemological and ontological pluralism (challenge 5) (please see the supplementary materials for more details on each concept in the timeline).

4. Synthesis and reflection

Now that the core challenges, the conceptual origins and the diversity of the CE have been reviewed, the next section synthesizes and reflects on these findings to analyse and differentiate the plurality of circularity discourses. The conceptual challenges highlighted in Section 3.1 are an effective starting point to unpack this diversity. They are thus the basis used for distinguishing circularity discourses according to their level of complexity (Section 4.1). This leads to the circularity discourse typology which allows for a clearer differentiation, navigation and comprehension of this contested paradigm (Section 4.2).

4.1. Classification of circularity discourses according to their level of complexity

Table 1 shows the different levels of complexity of circularity discourses depending on the extent to which they address the challenges reviewed in Section 3.1:

- Columns (a) and (b), represent spatial and temporal scales, the importance of which was evidenced in challenges 1 and 3 discussing global resource limits and the rebound effect.
- Column (c) shows which pillars of sustainability (people, planet, prosperity)[12] are included. The significance of this was seen in challenge 4, where the importance of social justice and political considerations was highlighted.
- Column (d) distinguishes ontological (anthropocentric vs ecocentric) and epistemological perspectives (ethnocentric vs plural), which were discussed in challenge 5.
- Column (e) relates to the complex interlinkages of the resource nexus, which was discussed in challenge 2.
- Column (f) refers to the questions of economic growth, capitalism and decoupling, which was analysed in challenge 1.
- Columns (g) and (h) reflect the core objectives and narratives and column (i) shows where each circularity concept group from the timeline (Fig. 3) fits.

To distinguish discourses that go beyond market-based solutions and economic considerations and see circularity as a holistic social transformation, the term *circular society* is proposed; this applies to complexity levels 4 and 5. A *circular society* defines discourses with a vision of circularity where not only resources are circulated in

[12] The people, planet, prosperity (PPP) framework represent a broad consensus on the core pillars of sustainability as evidenced by the review of Vermeulen (2018).

Table 1
Circularity discourse complexity.

Circularity vision	Complexity level	a) Temporal scale	b) Spatial scale	c) Sustainability factors included	d) ontology and epistemology	e) Perspective on the resource nexus	f) Views on capitalism and decoupling	g) Main goal/objective	h) Narrative	i) Circularity concept group
Circular Society	**5.**	Very long term: multiple generations (beyond 50 years)	Macro-scale: planet Earth	People, Planet, Prosperity	Ecocentric and plural	Changing consumption and production patterns to keep energy, biodiversity and material resources within safe planetary limits	Sceptical regarding the possibility of decoupling and the sustainability of capitalism	Maintaining socio-ecological health and wellbeing for present and future generations of human and non-human life	The earth is borrowed from future generations of living beings, humans must preserve, respect, restore and share it in a fair manner, even if that entails changing lifestyles and consumption patterns	Mainly Circularity 3.2 and most Precursors
	4.	Long term: 1 to 2 generations (20–50 years)	Macro-scale: planet Earth	People, Planet, Prosperity	Anthropocentric and ethnocentric	Balancing trade-offs and synergies to keep energy, biodiversity and material resources within safe planetary limits	Believe in the possibility of decoupling and the sustainability of capitalism	Preserving social well-being and the biophysical health of the earth system in line with the SDGs	Humans must ensure justice, fairness and participation in the sustainable stewardship of the earth, even if that entails redistributing and changing consumption patterns	Mainly Circularity 3.1
Circular Economy	**3.**	Long term: one generation (10–25 years)	Macro-scale: planet Earth	Planet, Prosperity	Anthropocentric and ethnocentric	Balancing trade-offs and synergies to keep energy, biodiversity and material resources within safe planetary limits	Believe in the possibility of decoupling and the sustainability of capitalism	Maintaining the biophysical health of the earth system	Reducing humanity's overall ecological footprint and balancing resource limits and constraints is key to ensure the stability of the biosphere and long-term economic prosperity	Mainly Circularity 2.0
	2.	Mid-term: 1 to 2 government planning cycles (5 to 10 years)	Meso-scale (country, region, industrial park, city)	Planet, Prosperity	Anthropocentric and ethnocentric	Optimizing and securing material, natural and energy resources, especially for critical raw materials	Believe in the possibility of decoupling and the sustainability of capitalism	Securing and preserving critical resources and materials	Strategically maximising eco-efficiency and balancing resource use is necessary to maintain resource security and ensure geopolitical stability	Mainly Circularity 1.0 and 2.0
	1.	Short term: single product life cycle (1 to 2 years)	Micro-scale (single product, service, or firm)	Planet, Prosperity	Anthropocentric and ethnocentric	Optimising material and energy resource flows in product design.	Believe in the possibility of decoupling and the sustainability of capitalism	Capturing opportunities to lower both environmental impacts and economic costs.	Ensuring optimum resource efficiency through eco-innovation leads to win-win solutions that reduce ecological harm and increase economic value	Mainly Circularity 1.0 and 2.0

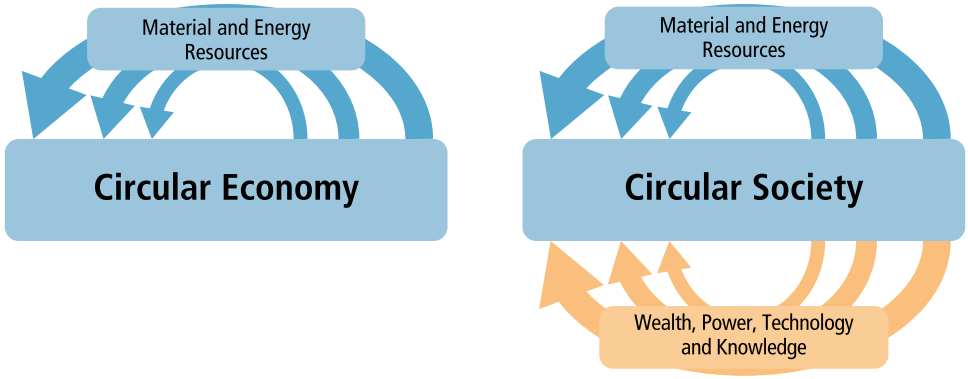

Fig. 4. Conceptual Differentiation between Circular Economy and Circular Society.

sustainable loops, but also wealth, knowledge, technology and power is circulated and redistributed throughout society (see Fig. 4). These discourses thus comprehensively include the three pillars of sustainability and see circularity as a holistic transition, where issues of political empowerment and social justice also have to be addressed. The term *circular economy*, in contrast to this, focuses on circulating resources alone and applies for complexity levels 1 to 3, which largely deal with circularity through a technical lens of ecological and material efficiency alone. Moreover, when discussing CE as a general umbrella concept, this article uses term *circularity* to comprehensively include all its historically related concepts and ideas (as seen in Fig. 3). Considering the importance of "policy labels, keywords and framing" for sustainability transitions (Silva et al., 2016, p. 224), these differentiations can help acknowledge and address the complex ecological, sociological and political implications of a circular future.

4.2. Development of a circularity discourse typology

While many are proposing a "deliberately vague but uncontroversial" (Lazarevic and Valve, 2017, p60) discourse on the CE as a strategy to gain widespread support in the short term, this could lead to a depoliticised CE, which does little towards tackling the systemic socio-ecological challenges of the Anthropocene (Korhonen et al., 2018b; Millar et al., 2019; Valenzuela and Böhm, 2017). Thus, it is key to propose alternative visions, which tackle the key conceptual challenges evidenced in Section 3. As Latouche (2018) rightly pointed out, the core challenge for global sustainability is to "decolonize the imaginary" and allow other futures to emerge. In the same manner, Korten (2015) speaks of "changing the story to change the future", Escobar (2018) argues for a "pluriversal imagination" needed for entirely different forms of "world making", and Feola (2019b) calls for the "unmaking of capitalism" to "make space" for a diversity of alternatives. A typology of circularity discourses must thus not only help better distinguish different circular discourses but also allow for an expansion of the imaginary regarding other possible circular futures.

While other classifications of environmental discourses have been developed previously, none has been specifically designed to comprehensively distinguish circularity discourses. Other environmental discourse typologies include Dryzek's (2013), which divides reformist versus radical positions with prosaic versus imaginative positions leading to four core discourses: *environmental problem solving* (prosaic and reformist), *green radicalism* (imaginative and radical), *survivalism* (prosaic and radical), and *sustainability* (imaginative and reformist).

Schwarz and Thompson (1990) build on the cultural theory of risk by adding a vision on the fragility of nature to the divide between cultural rationalities This leads to four core environmental discourses: *fatalist*, who see nature as capricious (unpredictable and uncontrollable), *individualist*, who see nature as benign (resilient and abundant), *egalitarians*, who see nature as ephemeral (fragile and limited), and *hierarchists*, who see nature as tolerant (resilient but only up to some extent) (Schwarz and Thompson, 1990).

Mann (2018) differentiates between *prophets* who call for urgent cut-backs in consumption to stay within planetary limits and *wizards* who propose optimistic technological solutions. Moreover, Audet (2016) distinguishes between *technocentrist* and *localist* transition discourses, the first being focused on scientific innovation, and the later on bottom-up social transformation.

Nevertheless, none of the abovementioned discourse typologies applies perfectly to circularity, as they are either too narrow, leaving some circularity discourses out; or too general and do not allow for a clear differentiation of the circularity concepts presented in Fig. 3. The typology of CE discourses presented in Fig. 5 draws inspiration from the division of environmental discourses developed by the above authors and adapts them to the CE by integrating the results of this research.

The first typological axis was developed from challenge 4, on social justice and governance, which many authors have identified as one of the most important issues for a circular future (Geissdoerfer et al., 2017; Hobson, 2019; Korhonen et al., 2018a; Millar et al., 2019; Moreau et al., 2017; Schröder et al., 2019a; Temesgen et al., 2019). This axis thus builds on the distinction between *circular society* and *circular economy* presented in Section 4.1 by dividing *holistic* from *segmented* discourses. *Holistic* discourses comprehensively integrate the social, ecological and political considerations of circularity (like *circular society* visions). *Segmented* discourses, on the other hand, have a homogeneous perspective and a uniform focus on only economic and technical components of circularity (like *circular economy* visions). This differentiation is similar to Dryzek's (2013) distinction between prosaic vs imaginative discourses but it is specifically focused on the circularity challenges reviewed in this article, and especially the distinction between *circular economy* and *circular society* concepts.

The second typological axis was developed from challenge 1 on capitalism, economic growth and decoupling (column (f) in Table 1). Recent research has found that this could be the most crucial element to transition discourses, as it deals with the ability, or inability, of the current socio-economic system to prevent ecological collapse by decoupling economic growth from environmental degradation (eco-economic decoupling)[13] (Feola, 2019a; Fergnani, 2019; Giampietro, 2019; Hickel and Kallis, 2019; Parrique et al., 2019). The second typological differentiation thus distinguishes whether discourses are *optimist* or *sceptical* about the capacity of technology and innovation to overcome the major ecological challenges of the Anthropocene before an irreversible socio-ecological collapse occurs. This differentiation is similar to the distinction between Mann's (2018) *prophets* and *wizards*, but it adds a stronger systemic and political dimension to it.

[13] Eco-economic decoupling is defined here as the absolute decoupling of environmental degradation from economic growth, meaning growing GDP while reducing absolute environmental impacts from production and consumption activities (Kjaer et al., 2019).

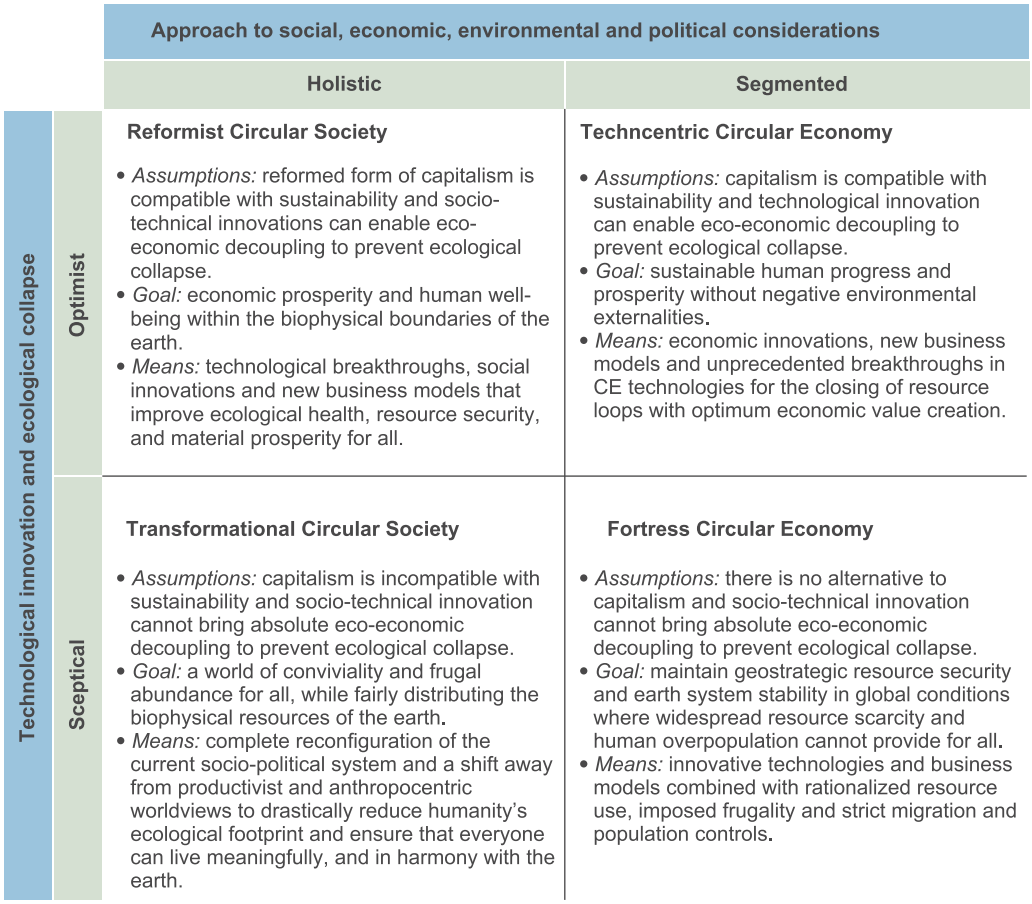

Fig. 5. Circularity discourse typology.

4.2.1. *Reformist circular society*

Holistic and *optimistic* discourses propose a mix of behavioural and technological change, leading to an abundant, fair, and sustainable future where scarcity and environmental overshoot has been dealt with by impressive social, economic, industrial and environmental innovations. While they believe important socio-cultural change is necessary, and new forms of public participation and inclusion are needed, they do not see a fundamental contradiction between capitalism and sustainability. *Reformist Circular Society* discourses thus argue that the current system can be deeply reformed toward circularity and believe that social and economic innovation can lead to a sufficient level of eco-economic decoupling to prevent a widespread ecological collapse. *Reformist Circular Society* discourses promote a variety of circular solutions such as industrial symbiosis, PSS, ecodesign and biomimicry, and they integrate the 3 main components of sustainability in their discourse, which is often framed around achieving the sustainable development goals while remaining within safe planetary boundaries. This discourse type considers solutions throughout all the value retention options of the CE, yet it gives a stronger focus to intermediate loops such as R2 reuse/resell, R3 repair, R4 refurbish, R5 remanufacture, R6 re-purpose, and R7 recycle.[14] All Circularity 3.1 concepts fall within this discourse type, as well as the positions of various NGOs and non-profits like Circle Economy (Verstraeten-Jochemsen et al., 2018) and the Club of Rome (von Weizsäcker and Wijkman, 2017) as well as cities like Amsterdam (as evidenced by Fratini et al., 2019). *Reformist Circular Society* has a lot in common to Dryzek's (2013) *sustainability* category of discourses. The name of this discourse type derives from Reike et al. (2018) *reformist* CE distinction combined with the *circular society* concept as described in Section 4.1.

4.2.2. *Transformational circular society*

Holistic and *sceptical* discourses propose an entirely transformed social system where individuals gain a renewed and harmonious connection with the Earth and their communities. A general economic downscaling and a philosophy of sufficiency leads to simpler, slower and more meaningful lives. Local production is emphasized, especially through cooperative and collaborative economic structures and by using agroecological techniques and open-source innovations and technologies that do not harm the biosphere nor deplete its limited resources, such as 3D printing, solar panels, wind turbines, cooperative P2P platforms, etc. This discourse type thus gives a stronger focus to the shorter loops in the CE value retention hierarchy, especially R0 refuse, R1 reduce, R2 reuse/resell, R3 repair, R4 refurbish, R5 remanufacture, and R6 re-purpose. *Transformational Circular Society* discourses also place a core emphasis on changing materialistic, anthropocentric, patriarchal, individualistic and ethnocentric worldviews to more holistic, plural, and inclusive ones. They also propose to redistribute global resources from nations and social sectors that grossly overshoot their ecological footprint to those that do not. *Transformational Circular Society* discourses emphasize direct participation and citizen inclusion in the democratic construction of the future, often through novel mechanisms of bottom-up governance. All Circularity 3.2 concepts and most Precursors fall in the *Transformational Circular Society* discourse

[14] This article follows the value-retention hierarchy (also called R-hierarchy, R-imperatives or simply R's) established by Reike, Vermeulen and Witjes (2018): R0 refuse, R1 reduce, R2 reuse/resell, R3 repair, R4 refurbish, R5 remanufacture, R6 re-purpose, R7 recycle materials, R8 recover energy, R9 re-mine.

type, as well as various social movements, such as the Great Transition Initiative and the Transition Towns Network (as evidenced by Feola and Jaworska, 2019), local bottom-up circular initiatives such as De Ceuvel in Amsterdam (as evidenced by Hobson, 2019) and R-Urbain in Paris (as evidenced by Marin and De Meulder, 2018), and many indigenous movements form the Global South (Kothari et al., 2019). These discourses are similar to Dryzek's (2013) *green radicalism* as well as Schwarz and Thompson's (1990) *egalitarians*. The name of this discourse type derives from Reike et al. (2018) *transformational* CE distinction combined with the *circular society* concept as described in Section 4.1.

4.2.3. Technocentric circular economy

Segmented and *optimistic* discourses propose an era of green-growth and technological advancements, which allow for increasing levels of prosperity while reducing humanity's ecological footprint. These discourses thus expect that circular innovations can lead to an absolute eco-economic decoupling to prevent ecological collapse. To do so many win-win solutions are promoted such as PSS, EPRs, biomimicry reverse logistics, industrial symbiosis, remanufacturing, refurbishing, big data, and eco-design, as well as controversial innovations such as carbon capture and storage, artificial intelligence, geoengineering, and synthetic biology. This discourse type thus gives a stronger focus to the larger loops in the CE value retention hierarchy, especially R4 refurbish, R5 remanufacture, R6 re-purpose, R7 recycle, R8 recover energy and R9 re-mine. These discourses are common in European government policies (as evidenced by Colombo et al., 2019; Kaźmierczyk, 2018; Pardo and Schweitzer, 2018; Repo et al., 2018; Rijnhout et al., 2018), CE development plans in cities such as London (as evidenced by Fratini et al., 2019), corporate strategies such as Apple's (as evidenced by Valenzuela and Böhm, 2017; Vonk, 2018), business consultancies such as McKinsey and some international organizations including the World Economic Forum, the International Resource Panel, and the OECD (IRP, 2019; OECD, 2018; WEF et al., 2016). These institutions focus mostly on new technologies, innovations and business models as avenues for green growth, without mentioning social justice and participatory governance. Circularity 1.0 and 2.0 concepts fall within the *Technocentric Circular Economy* discourse type, which has a lot in common with Audet's (2016) *technocentrist* discourses. The name, of this discourse type, in fact, derives from Audet's (2016) *technocentrists,* combined with the *circular economy* concept as described in Section 4.1.

4.2.4. Fortress circular economy

Segmented and *sceptical* discourses have a vision of a future where scarce resources, overpopulation and biophysical limits require strong cohesive measures. These discourses thus seek to impose sufficiency, population controls and resource efficiency from the top down to rationally confront global scarcity and limits, yet they do not deal with questions of wealth distribution and social justice. This is evident in the texts of precursors such as Catton (1980), Ehrlich (1968), and Hardin (1968), all of which build on Malthusian theories of overpopulation and resource scarcity to advocate for strong population control and materials efficiency strategies. This discourse type thus considers solutions throughout the entire CE value retention hierarchy (R0-R9). These positions have often been criticised as sexist, elitist, and ethnocentric as they involve white, male, scientists from the Global North imposing sufficiency and limits to populations, which for the most part, had very little to do with the crisis at hand (Dryzek, 2013; Fressoz and Bonneuil, 2016). These type of discourses have also historically existed in authoritarian regimes such as in Nazi Germany and the German Democratic Republic, which developed "Kreislaufökonomie" (*circulatory economy*) policies to conserve and recycle resources in conditions of geopolitical conflict, economic strife and resource scarcity (Corvellec et al., 2020). More recently, the ecological concerns and resource limits of the 21st century have led to a growing “disaster capitalism”,[15] in which investors, entrepreneurs and venture capitalists see green solutions and business models as new opportunities for capital expansion (Fletcher, 2019, 2012). Many states and corporations are thus already using a framing of scarcity to grab land and resources in the Global South and develop infrastructures and technologies to ensure resource security (Cavanagh and Benjaminsen, 2018; Mehta et al., 2019). There is also a growing number of NGOs, think tanks and governments using a discourse of climate change, scarcity and overpopulation to protect geopolitical power, resources and prosperity from migrant people from the Global South (Hendrixson and Hartmann, 2019). This narrative is clear in a Pentagon-commissioned report arguing that wealthy nations may “build defensive fortresses around their countries […] to hold back unwanted starving immigrants” and preserve their resources (Schwartz and Randall, 2003 p. 18). *Fortress Circular Economy* discourses are similar to Schwarz and Thompson's (1990) *fatalists*, and Dryzek's (2013) *survivalists*. Moreover, like *fatalists* and *survivalists,* the proponents of this discourse type do not always engage in mainstream debate since they have rather cynically realist visions. Yet, they might often be the underlying focus of many business and government discussions on circularity, especially when they are based on a narrative of geopolitical resource security, overpopulation and economic competitiveness.

4.2.5. Circularity discourses and concepts through history

Table 2 presents the position of each concept from the timeline in relation to the discourse typology. The most widespread discourse in the literature is *Transformational Circular Society* (42% of reviewed concepts), followed by *Reformist Circular Society* (28% of reviewed concepts), *Technocentric Circular Economy* (26% of reviewed concepts) and *Fortress Circular Economy* (4% of reviewed concepts). On the other hand, revising 120 academic, government and practitioner definitions of the CE reveals that 101 of them (84%) fall in the *Technocentric Circular Economy* discourse type, 14 in *Reformist Circular Society* (12%), 3 in *Fortress Circular Economy* (2.5%), and 2 in the *Transformational Circular Society* (1.5%) (please see supplementary materials for details). There is thus a discrepancy between the diversity of *holistic* CE-related concepts in the literature, and the most common definitions of the CE term, which are generally situated within *segmented* and *optimist* discourse types. The present status quo of the CE discourse is thus in the *Technocentric Circular Economy* discourse type, despite of the significant literature on other circular discourses. This is in line with results of D'Amato et al. (2019), which found that academics had a more degrowth or post-growth oriented perspective on circularity than mainstream CE propositions (D'Amato et al., 2019).

It is also worth noting that there has been a shift in circularity discourses through time. A plurality of *Transformational Circular Society* discourses prevailed in the 1960s and 1970s, as most precursors had a strong understanding of planetary limits and comprehensively addressed the main social and systemic challenges of a circular future. Later, in the 1990s and early 2000s, *Technocentric Circular Economy* discourses of circularity 1.0 and 2.0 became dominant and focused on sophisticated technical innovations instead of wholescale socio-political transformations. This is closely synchronous with the rise of neoliberalism and its market-based approach to environmental issues. Since the 2008 economic crisis, *Reformist* and *Transformational Circular Society* discourses have become more widespread, showing a slowing faith in the market and a re-examination of the socio-political dimensions of circularity.

[15] The term “disaster capitalism” originates from Naomi Klein, which defines it as “orchestrated raids on the public sphere in the wake of catastrophic events, combined with the treatment of disasters as exciting marketing opportunities” (cited in Fletcher, 2012, p.99) this crisis-driven narrative have been used to control natural resources and commodify nature (Fletcher, 2019, 2012).

Table 2
Concepts within each circularity discourse type.

Discourse	Concepts from the Timeline	
Reformist Circular Society (20 concepts)	**N. 20 Circularity 3.1 concepts:** 1. Rio Declaration on Environment and Development (UN, 1992) 2. Regenerative design (Lyle, 1994) 3. Natural Capitalism (Hawken et al., 1999) 4. Sound Material-Cycle Society (Government of Japan, 2000) 5. Cyclical Economy (Young et al., 2001) 6. Materials Matter (Geiser, 2001) 7. Cradle to Cradle (McDonough and Braungart, 2002) 8. The Natural Step (Robèrt, 2002) 9. Performance Economy (Stahel, 2010)	10. Blue economy (Pauli, 2010) 11. Material Efficiency (Allwood et al., 2011) 12. Third industrial revolution (Rifkin, 2013) 13. Eco-system economy (Scharmer and Kaufer, 2013) 14. Regenerative capitalism (Fullerton, 2015) 15. Sharing Economy (Frenken, 2017) 16. Doughnut Economics (Raworth, 2017) 17. Symbiotic Economy (Delannoy, 2017) 18. Social Circular Economy (Social Circular Economy, 2017) 19. Spiral Economy (Ashby et al., 2019) 20. Coviability (Barrière et al., 2019)
Transformational Circular Society (30 concepts)	**N. 13 precursor concepts:** 1. Gandhian economics (Kumarappa, 1945) 2. The Economics of the Coming Spaceship Earth (Boulding, 1966) 3. The entropy law and the economic process (Georgescu-Roegen, 1971) 4. The Closing Circle (Commoner, 1971) 5. Social Ecology (Bookchin, 1971) 6. Ecological Design (Papanek, 1972) 7. Limits to Growth (Meadows et al., 1972) 8. Small is Beautiful (Schumacher, 1973) 9. Conviviality (Illich, 1973) 10. Steady-state economics (Daly, 1977) 11. Permaculture (Mollison and Holmgren, 1978) 12. Décroissance (Gorz, 1980) 13. Deep Ecology (Næss and Rothernberg 1989) **N. 17 Circularity 3.2 concepts:** 1. Transition Movement (Hopkins, 2008)	2. Degrowth (Latouche, 2009) 3. Eco-socialism (Löwy, 2011) 4. Laudato Si' (Pope Francis, 2015) 5. Transition design (Irwin, 2015) 6. Economy for the Common Good (Felber, 2015) 7. Post-growth (Jackson, 2016) 8. Permacircular Economy (Bourg, 2018), 9. Voluntary Simplicity (Trainer and Alexander, 2019) 10. Convivalism (Caillé, 2019) 11. Buen Vivir/ Sumark Kawsay (Government of Ecuador, 2008) 12. Ubuntu (Shumba, 2011) 13. Ecological Civilization (Zhang et al., 2011) 14. Ecological Swaraj (Kothari et al., 2014) 15. Suma Qamaña / Vivir Bien (Artaraz and Calestani, 2015) 16. Buddhist, Confucian and Taoist ecology (Arler, 2018) 17. Radical Pluralism/ Pluriverse (Kothari et al., 2019)
Technocentric Circular Economy (19 concepts)	**N. 15 concepts from Circularity 2.0:** 1. Industrial Ecology (Frosch and Gallopoulos, 1989) 2. Circular Economy (Pearce and Turner, 1989) 3. Eco-design /Design for environment (Ryan et al., 1992) 4. Cyclic Economy (Tibbs, 1993) 5. Industrial Metabolism (Ayres and Simonis, 1994) 6. Cleaner Production (Baas, 1995) 7. Reverse Logistics (Rogers and Tibben-Lembke, 1998) 8. Eco-industrial parks and networks (Côté and Cohen-Rosenthal, 1998)	9. Biomimicry (Benyus, 1998) 10. Product Service System (Goedkoop et al., 1999) 11. Extended Producer Responsibility (Lindhqvist, 2000) 12. Industrial Symbiosis (Chertow, 2000) 13. Closed-loop Supply Chain (Guide et al., 2003) 14. Biobased Economy / Bioeconomy (OECD, 2004) 15. The Biosphere Rules Unruh, 2008 **N. 4 Circularity 1.0 concepts:** 1. Waste-Water Treatment (Holcomb, 1970) 2. Integrated Solid Waste Management and Recycling (Levick and Davies, 1975) 3. Bio-Digestion (Hughes, 1975) 4. Energy Recovery (Boyle, 1977)
Fortress Circular Economy (3 concepts)	**N. 3 precursor concepts:** 1. The tragedy of the Commons (Hardin, 1968) 2. The Population Bomb (Ehrlich, 1968) 3. Overshoot (Catton, 1980)	

5. Discussion

This paper's approach involved first investigating the current limits of the discussion on the CE (Section 3.1), and then recognising that the term is actually much older and much more diverse than what is usually conceived (Section 3.2). Through this broader view of circularity as an umbrella concept, the authors developed a new circularity discourse typology, which attempts to unpack and navigate the full complexity of its ideas (Section 4). This section reflects on the conceptual and methodological implications of this research.

5.1. Conceptual implications of each circularity discourse type

Each one of the above circularity discourse types has different conceptual strengths and weaknesses, especially in relation to the 5 main challenges identified in Section 3.1 (1. growth, entropy and decoupling, 2. materials-energy-biodiversity nexus, 3. CE impact-assessment and the rebound-effect, 4. socio-political implications of the CE, 5. alternative visions of circularity) as well as the 5 levels of complexity presented in Section 4.1 (please see Table 1).

Technocentric Circular Economy discourses focus on implementable technical innovations, which can transform the industrial production system without having to change social-economic power relations. *Technocentric Circular Economy* visions are thus practical and applicable, which makes them appealing for a broad range of actors seeking win-win solutions to reconcile environmental and economic objectives. However, *Technocentric Circular Economy* discourses fail to deal with all challenges identified in Section 3, as they do not address issues of entropy, planetary limits, rebound effects, and the social implications of circularity, and only sometimes deal with challenge 2 on the resource nexus. They thus fall within complexity level 1 to 3 of Table 1, depending on their spatial and temporal scale and their perspective on the resource nexus. *Technocentric Circular Economy* discourses might hence be unappealing to social and environmental groups seeking a more holistic, inclusive and systemic response to the socio-ecological challenges of the 21st century.

Reformist Circular Society discourses answer many of these concerns, particularly in terms of social justice, participatory governance and the

resource nexus (challenges 2 and 4) and sometimes acknowledge the issues revolving around the rebound effect (challenge 3). *Reformist Circular Society* discourses thus perhaps have the most largely appealing vision of circularity, as they add a human dimension and seek to reconcile capitalism with a just and sustainable future for all. However, these discourses fail to confront questions of entropy, economic growth, decoupling and epistemological and ontological pluralism (challenges 1 and 5). *Reformist Circular Society* discourses are thus within complexity level 4 of Table 1 and might be unappealing to social movements with plural and ecocentric perspectives.

Transformational Circular Society discourses address all the 5 challenges identified in Section 3 by seeking a wholescale transformation of the entire socio-economic system and not just its industrial model. They are thus in complexity level 5 of Table 1. *Transformational Circular Society* discourses have a rational analysis of current planetary limits and the structural contradictions of the capitalist system and propose a utopic vision that is appealing for many social and environmental movements. However, they might be disregarded by mainstream debates for being overly idealist regarding the likelihood of fundamental socio-cultural change and the probability of a post-capitalist future.

In contrast to this, *Fortress Circular Economy* discourses are neither optimist about the possibility of eco-economic decoupling nor about fundamental socio-cultural change. They address some systemic challenges (1, 2 and 3), but instead of proposing socially desirable solutions, they seek to manage and/or take advantage of the crisis in a top-down manner. *Fortress Circular Economy* discourses are thus clearly not as universally desirable as they do not address social, cultural and governance considerations (challenges 4 and 5). However, they nonetheless play a key role in shaping circularity debates, especially in geostrategic policy and business circles as they are the most realistic of all discourses due to their rational and unidealistic understanding of systemic conditions. As the socio-ecological crisis of the Anthropocene worsens and climate change intensifies, *Fortress Circular Economy* positions might become much more widely accepted, especially in a context where "it is easier to imagine an end to the world than an end to capitalism"[16] (Fisher, 2009). Yet, these discourses can easily lead to a divided and unequal world of haves and have-nots; a type of *eco-apartheid* (Malleson, 2016) (or fortress Europe/North America*)* where only a few nations can invest in new circular solutions and gain access to the technologies and means to a materially affluent life (Monsaingeon, 2017; Valenzuela and Böhm, 2017). In fact, in a 2019 report, Philip Alston, the UN Special Rapporteur on extreme poverty and human rights, has already spoken of a "climate apartheid scenario in which the wealthy pay to escape overheating, hunger, and conflict, while the rest of the world is left to suffer" (Alston, 2019, p. 14).

Considering the strengths and weaknesses of each circularity discourse, there is great value in opening up the debate on circularity to allow for a more complex discussion of the core challenges of a circular future. Indeed, some discourses might lack realism, while others might lack feasibility. A cross-pollination of ideas and perspectives is thus beneficial to develop better policies, practices and research projects. Future transdisciplinary research and participatory policymaking with deliberative mechanism can help bring all discourses to the table and establish more inclusive, legitimate, achievable and sustainable circular futures. On the other hand, if a more plural debate on circularity is not held, there is a high risk that a depoliticised discourse of circularity dilutes the complexity of the present socio-ecological crisis. This simple and uncontroversial discourse of circularity could create many new business opportunities for some, by expanding capital accumulation into the realm of waste materials and bio-resources. Yet, it will likely create a rebound effect and, thus, do very little towards actually reducing humanity's ecological footprint. Moreover, it can lead to the enclosure, commodification, and marketization of nature and the commons, which replicates global environmental injustices and ends up making circularity "a luxury" (Schröder et al., 2019b, p13).

5.2. Methodological implications and challenges of building a discourse typology

There are inevitable simplifications involved in the development of a discourse typology. Each concept within the typology is thus much more diverse than can be evidenced in this research. For instance, there is a large diversity of visions of Degrowth (Kallis et al., 2018) and the Bioeconomy (Hausknost et al., 2017). This discourse typology cannot distinguish all the intricate sub-types within each discourse, rather it shows their commonalities and simplifies their complexity so they can be understood in relation to other discourses. Further research can build on this to analyse how different academic, public and private discourses fit within this discourse typology. In addition to this, Table 1 can help distinguish the diversity of *Technocentric Circular Economy* proposals, by classifying them in complexity levels 1 to 3.

Some discourses might not always be easily distinguishable black or white propositions and could present multiple shades and nuances. Indeed, some discourses could be "hybrids", which include elements of a number of the 4 discourse types presented in this article. Further case study research on specific circular sectors or stakeholders, using this typology should acknowledge this complexity in their analysis of circular discourses, policies and practices. A particular stakeholder might thus have a prominently *Technocentric Circular Economy* discourse with moderate notes of *Reformist Circular Economy*. Moreover, some actors might have discrepancies between their practices and their discourses, such as having a *Reformist Circular Society* discourse and *Fortress Circular Economy* practices. Future research can address these complexities by combining this typology with methodological tools such as Q-methods and corpus-based discourse analysis.

While 26 of the 72 concepts in the timeline (36%) were from non-academic origins[18], and various circularity positions from government, civil society or business practitioners were reviewed (E.g., European Commission, 2015; IRP, 2019; OECD, 2018; Schwartz and Randall, 2003; Verstraeten-Jochemsen et al., 2018; von Weizsäcker and Wijkman, 2017; WEF et al., 2016), the majority of literature in this research originates from academia. This represents another limitation of this paper. Future research can use the typology as a theoretical framework to analyse discourses from the public and private sectors. This could help uncover different circularity discourses and better understand their main strengths and weaknesses as well as test, improve and update the discourse typology here proposed. Considering that the CE is still a contested concept with many public and private actors competing to influence its meaning and interpretation, this is a particularly important avenue for future research.

A final limitation of this research is that it is mostly based on desk research. Another method to build a discourse typology could be

[16] Fisher attributes this quote to both Fredric Jameson and Slavoj Žižek (Fisher, 2009)

[17] It is worth noting that the timeline does not strictly follow the dates proposed by Reike et al. (2018) or Blomsma and Brennan (2017) as it is a new proposition. Moreover, each time period overlaps, showing that ideological phases do not necessarily have strict start and end date but rather gradients with moments of prominence and decline. A detailed and interactive version of this timeline is available in the following web-page: http://cresting.hull.ac.uk/impact/circularity-timeline.

[18] Waste-Water Treatment, Solid Waste Management and Recycling, Bio-Digestion, Energy Recovery, Cyclic Economy, Reverse Logistics, Biomimicry, Product Service System, Extended Producer Responsibility, Bioeconomy, Rio Declaration on Environment and Development, Natural Capitalism, Sound Material-Cycle Society, Cyclical Economy, The Biosphere Rules, Performance Economy, Blue economy, Buen vivir/Sumak Kawsay, Regenerative capitalism, Social Circular Economy, Transition Movement, Laudato Si', Economy for the Common Good, Ubuntu, Ecological Civilization, Suma Qamaña/Vivir Bien.

through a set of workshops and focus group discussions with various practitioners and academics. The limitations of a participatory approach are the complexities in obtaining a diverse enough sample of stakeholders and adequately covering discourses from many different countries and continents. They can thus easily result in typologies that only apply to certain cultural or geographical contexts or only represent a limited range of discourses. Nonetheless, for future research on the topic, there is significant potential to hold participatory workshops where the discourse typology here developed is used as the theoretical basis to analyse the discourse and practices of specific CE sectors and actors. This would allow for innovative research that unpacks different practitioner discourses of the CE and can help validate, adapt and improve the discourse typology here developed.

6. Conclusions

As the CE concept is in a phase of "validity challenge", it can still take many different directions, which will determine whether it will collapse, cohere or persist as a contention (Blomsma and Brennan, 2017). Considering how widely adopted the concept has become within both academic and non-academic sectors, there is a unique opportunity to use it as a tool for transformative change. Yet, if corporate and government actors continue to use a CE framing that doesn't consider systemic socio-ecological implications, the term could easily become discredited as a refurbished form of greenwashing. This paper brings analytical tools to assess these discursive practices, untangle their meaning, and expand the debate to a plurality of alternative circular futures.

Indeed, the circularity discourse typology can help both academics and practitioners better analyse current policies and practices on circularity and sustainability transitions in general. By fostering plurality and openness to other visions, the discourse typology can promote more holistic and systemic thinking, which comprehensively includes different circular futures. Moreover, it can contribute to the democratization of governance and policy mechanisms by helping to situate and include less prominent voices and discourses and to contrast current practices and proposed actions with a plurality of alternatives. The final scope of this research is thus to open the imaginary towards a plural circular future in which many sustainable futures can be hospitably embraced.

One core challenge and implication of these results is that evidencing discursive differences could bring opposing discourses apart, rather than together. Research on deliberative democracy and collaborative decision making has shown that a better understanding of conflicting ideas can actually promote respect, trust, innovation, and consensual cooperation (Calisto Friant, 2019; Dryzek et al., 2019; Friend and Hickling, 2005; Schwarz and Thompson, 1990). By unpacking and navigating different discourses of circularity, this article thus hopes to promote greater inclusiveness, collaboration and pluralism in the debate and implementation of this contested paradigm.

The authors encourage the use, adaptation and improvement of this discourse typology to further build on this work, which can be seen as a continuous participatory thought process with other scholars and practitioners. There is a particularly promising potential for innovative future research, which builds on the discourse typology developed in this paper from the perspective of many inter and trans-disciplinary academic fields such as mission-oriented innovation policy, political ecology, futures studies, science and technology studies, critical systems thinking, and participatory action research. This can lead to the cross-pollination of ideas and can help both academics and practitioners in their development of policies and practices, which positively contribute to the complex socio-ecological challenges of the 21st century.

Declaration of Competing Interest

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

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Supplementary materials

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