FROM CIRCULAR ECONOMY TO CIRCULAR SOCIETY

Analysing circularity discourses and policies and their sustainability implications

Martin
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ISBN: 978-94-6458-778-4
DOI: https://doi.org/10.33540/1562

Design and layout: AgileColor
Printing: Ridderprint

From circular economy to circular society: analysing circularity discourses and policies and their sustainability implications

Van circulaire economie naar circulaire samenleving: een analyse van narratieven en beleid rond circulariteit en hun duurzaamheidsimplicaties

(met een samenvatting in het Nederlands)

Proefschrift

ter verkrijging van de graad van doctor aan de
Universiteit Utrecht
op gezag van de
rector magnificus, prof.dr. H.R.B.M. Kummeling,
ingevolge het besluit van het college voor promoties
in het openbaar te verdedigen op vrijdag 16 december 2022 te 12:15 uur

door

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Dit proefschrift werd (mede) mogelijk gemaakt met financiële steun van the European Union's Horizon 2020 research and innovation programme under Marie Sklodowska-Curie grant agreement No 765198.

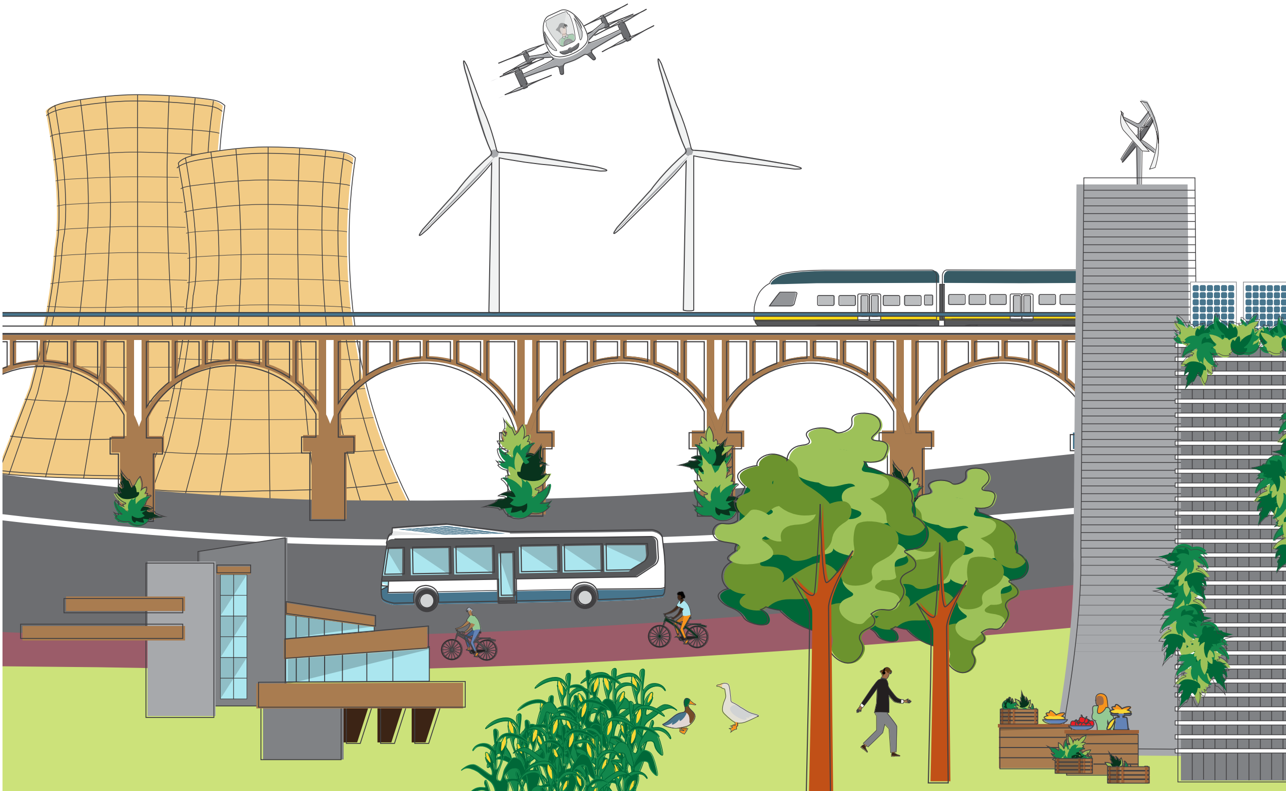
Contents

Chapter 1

Introduction

"A richer life is not only compatible with the production of fewer goods, it demands it. Nothing—other than the logic of capitalism—prevents us from manufacturing and making available to everyone adequate accommodation, clothing, household equipment, and forms of transportation which are energy conserving, simple to repair, and long lasting, while simultaneously increasing the amount of free time and the amount of truly useful products available to the population."

(Gorz, 1980, p.28)



1.1 The sustainability challenges of the 21st century

At the dawn of the 21st century, humanity is facing a historical set of socio-ecological challenges that could determine its very survival on planet earth. Overcoming these challenges might ultimately transform the very shape of the world and the nature of human societies. The exact shape and form of this transformation will depend on the choices we take now. Humanity is already overshooting six out of nine planetary boundaries which maintain the equilibrium of the earth system (i.e. climate change, biodiversity loss, land-use change, toxic novel entities, freshwater change, and phosphorus and nitrogen cycles) (Persson et al., 2022; Steffen et al., 2015; Wang-Erlandsson et al., 2022). Moreover, humanity remains deeply divided and unequal with a large share of the human population still unable to securely access its most basic needs, such as food, water, energy, sanitation, housing, education, and healthcare (Raworth, 2017)[1]. Poverty, determined at 5.5 USD PPP a day, still affects over 40% of humanity (World Bank, 2022), yet 26 people have as much wealth as the bottom half of the human population (Lawson et al., 2019). There are thus deep disparities between the large proportion of the human population that cannot meet their basic needs and a powerful minority that grossly overshoots their fair share of planetary resources (Di Chiro, 2019; Helne and Hirvilammi, 2019). In fact, the richest 10% are responsible for over 48% of annual global GHG (greenhouse-gas) emissions while the poorest 50% are responsible for only 12% of global GHG emissions (Chancel, 2021). The wealthiest 10% thereby consume close to 30 times more than their fair share of GHG emissions to stay within the Paris target of 1.5 C degrees, and the wealthiest 1% consume about 100 times more than their fair share (Chancel, 2021). Similarly, in terms of material footprint, it is estimated that the richest 10% of the global population consumes about 70% of global resources while the poorest 10% consume only 1% (IRP, 2019; Marín-Beltrán et al., 2022). Accounting for both material and carbon footprints, the wealthiest 10% of the world are responsible for 25 to 43% of humanity's total ecological footprint, while the poorest 10% are responsible for only 3 to 5% (Teixidó-Figueras et al., 2016; Wiedmann et al., 2020). These inequalities in environmental pollution and GHG emissions persist, while the actual impacts of climate change and ecological degradation will disproportionally affect peoples and countries in the Global South compared to those in the Global North (IPCC, 2022).

This situation is unquestionably unsustainable and unjust and has led many academics and social movements throughout the world to call for a deep transition to ensure the wellbeing of all while staying within safe ecological boundaries (Gupta et al., 2021; Hickel, 2019; O'Neill et al., 2018; Raworth, 2017). To do so, in the context of massive global inequalities, there is a pressing need to "shrink and share" humanity's use of natural resources in a fair, sustainable, and democratic manner (Ness, 2022). Indeed, it is not only necessary to shrink our impact on

1 Globally 11% of human population is undernourished, 15%, is illiterate, 9% lacks access to water, 32% lacks access to sanitation, 17% lacks access to electricity, 57% lacks access to the internet, 24% lacks access to adequate housing (Raworth, 2017).

the planet to stay within safe planetary boundaries but also to share global resource use so that all humans can have access to the means for a fulfilling life. Massive inequalities in global wealth and resource use should thus be reduced so that no one can grossly overshoot their fair share of planetary resources, and no one remains unable to access the bare minimum for a good life (e.g. housing, education, food, water, healthcare) (Fanning et al., 2021). Many academics thus argue that a wide-scale redistribution of wealth and planetary resources is essential not only to ensure the functioning of basic planetary systems but also to ensure that all humans have access to a meaningful, free, and dignified life (D'Alisa et al., 2014; Hickel, 2021; Jackson, 2021; Latouche, 2009; Ness, 2022; Trainer and Alexander, 2019).

1.2 CE as a contested "umbrella paradigm"

The concept of a circular economy (CE) has been proposed as a solution to this multifaceted socio-ecological crisis by various academics (e.g. Stahel, 2010), public institutions (e.g. European Commission, 2015), and private organizations (e.g. Ellen MacArthur Foundation, 2015). These proponents expect many benefits from the implementation of CE practices. By creating a production and consumption system without waste through the slowing, narrowing and closing of resource loops, a CE could solve the problems of material resource scarcity (Homrich et al., 2018; Stahel, 2016; Suárez-Eiroa et al., 2019). By establishing a renewable energy production system with zero pollution and a regenerative agricultural system, the CE could also solve the problem of climate change and food scarcity (Borrello et al., 2020; Delannoy, 2017; Geisendorf and Pietrulla, 2018). By creating an industrial and social system that produces only positive environmental externalities, it could solve the problems of biodiversity loss, biochemical flow disruption, and water scarcity (McDonough and Braungart, 2002; Stahel, 2010; Velenturf and Purnell, 2021). Moreover, by developing innovative "glocal" systems of collaborative design, production and consumption, the CE could inspire the sustainable revitalization of local and regional economies, leading to a reduction of inequalities, unemployment and poverty in the Global North and South alike (Arnsperger and Bourg, 2017; Schröder et al., 2020).

However, the CE concept is facing many challenges and limitations to reach those ambitions (Millar et al., 2019; Skene, 2018; Valenzuela and Böhm, 2017). The use of the CE concept grew very rapidly in academic, policy and business sectors in the last decade but it is still very much in construction and evolution (Antikainen et al., 2018; Blomsma and Brennan, 2017; Winans et al., 2017). There is hence much divergence between different circular economy and society perspectives. Researchers have found 114 different definitions (Kirchherr et al., 2017) and 38 different Rs (value retention options such as reduce, reduce, recycle) in the literature (Reike et al., 2018a)[2]. The mix of widespread support and enthusiasm for the CE

2 This thesis follows the value-retention options (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.

with the lack of conceptual clarity and consistency has led Korhonen et al. (2018b) to call it an “essentially contested concept”. As with other essentially contested concepts, various actors compete to influence the discourse on the CE for their specific objectives and promote an interpretation of the CE, which fits with their political, social, and economic agendas (Korhonen et al., 2018b; Repo et al., 2018). It has also been argued that many of these actors have chosen to use a “deliberately vague, but uncontroversial” discourse on the CE as a strategy to gain widespread support in the short term (Lazarevic and Valve, 2017, p60). Mainstream CE propositions are often depoliticised and don’t address key socio-ecological implications of a circular future such as: How are benefits shared and costs distributed? Who controls CE technologies and patents? Are there any ecological rebound effects or unintended social impacts to circular solutions? What are the sustainability implications of different CE visions, projects, and policies? To address those questions, we must first ask what circles, cycles and flows mean for an economy and a society in the first place.

1.3 Research gap: what on Earth is circular about an economy?

Human societies and our planet function through a wide diversity of cycles and flows. While there are countless socio-ecological cycles and flows, the literature on sustainability can help us find the most relevant ones in relation to the manyfold CE challenges identified above. Reviewing decades of literature on sustainability, sustainable development and life cycle thinking, Vermeulen highlights that the literature focuses on a dual “agenda of integral ecological and societal fairness” (2018, p73); and identifies a number of crucial elements needed to sustain human and planetary wellbeing (see table 1.1). These elements can be resumed in the following seven cycles, which can help understand what circularity means in relation to socio-ecological sustainability (see Figure 1.1):

1. Biogeochemical cycles of the Earth
2. Ecosystem cycles
3. Resource cycles of materials and energy
4. Political cycles of power
5. Economic cycles of money and wealth
6. Knowledge cycles of technology, information, and education
7. Social cycles of care

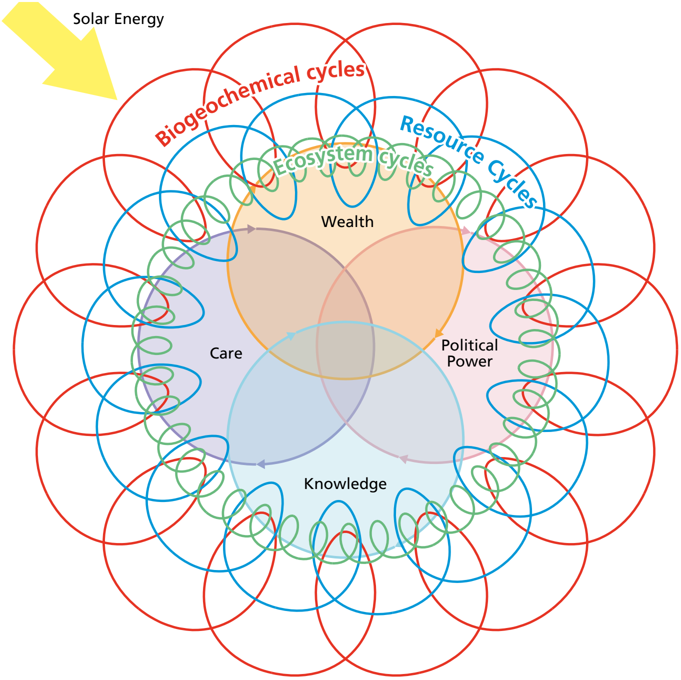


FIGURE 1.1 | Seven key socio-ecological cycles (the red, blue, and green loops around the figure represent biophysical cycles while the 4 circles in the middle represent social cycles. All the cycles intersect one another to reflect their multiple interconnections, interdependencies, and interactions).

TABLE 1.1 | Relationship between selected socio-ecological cycles and human and planetary wellbeing in sustainability literature (based on Vermeulen, 2018).

Cycle	Relation to 27 midpoints (business outputs) affecting human and planetary wellbeing	Relation to 6 endpoints ('areas of protection') essential for achieving human and planetary wellbeing
Biogeochemical cycles of the Earth	Climate change, Ozone depletion,	Natural resources (availability)
Ecosystem cycles	Acidification, Eutrophication, Ecotoxicity, Land-use & degradation	Natural environment (ecosystems)
Resource cycles of materials and energy	Water resource depletion, Resource depletion (other), Nuisance	Natural resources (availability)
Political cycles of power	Human rights, Zero corruption, Responsible political involvement, Compliance	Societal stability

Cycle	Relation to 27 midpoints (business outputs) affecting human and planetary wellbeing	Relation to 6 endpoints ('areas of protection') essential for achieving human and planetary wellbeing
Economic cycles of money and wealth	Labour rights and conditions, Employment benefits, Remuneration & wages, Employment, Fair inequality, Compliance with regulations, Fair contracts & competition, Fair tax behaviour,	Fairness in the economic system, Worker wellbeing, Societal stability
Knowledge cycle of technology, information, and education	Development & learning, Product safety & informing, Fair marketing, Sustainable innovation,	Societal stability, Fairness in the economic system
Social cycles of care	Gender & ethnic equality, Resource & cultural heritage, Health & safety, Human health-related pollution	Community livelihood

1.3.1 Biogeochemical cycles of the Earth

The Earth functions through many complex biogeochemical cycles such as the water, carbon, nitrogen, oxygen, hydrogen, iron, sulphur and phosphorus cycles (Steffen et al., 2015). These cycles lead to the circulation and transformation of matter and energy on planet Earth through various biological and geological processes, such as transpiration, erosion, wind circulation, ocean currents, and the movement of continental plates (Folke et al., 2021). By doing so, they ensure that energy and materials are available to different ecosystems and organisms throughout the Earth. These cycles also ensure the stability of global weather patterns and maintain the integrity of the Earth's atmosphere and its ozone layer (Folke et al., 2021). Life on earth thus depends on these cycles, and maintaining their effective circulation is thereby imperative. Yet, our societal system is seriously disrupting all of the above cycles, especially the carbon cycle, which is causing climate change, but also the water, phosphorus and nitrogen cycles, which are affecting key ecosystems and reducing our ability to produce sufficient food (Mayumi and Giampietro, 2019; Murray et al., 2017; Steffen et al., 2018).

1.3.2 Ecosystem cycles

Biodiversity and natural ecosystems also work through cycles which allow for the continuous reproduction and regeneration of life (Skene, 2018). Energy flows through ecosystems, entering first as sunlight via photosynthetic organisms such as plants, algae and phytoplankton and succeeding through the different trophic levels of the food web

(Hanumante et al., 2019)[3]. Nutrients are thereby continuously cycled in natural ecosystems in a regenerative manner as the waste of one specie is food for another[4] (Capra and Jakobsen, 2017).

These ecosystem cycles provide key functions and services that enable the existence and reproduction of life and human societies such as plant pollination, flood regulation, water purification, soil formation, disaster risk reduction, climate adaptation, carbon sequestration etc. (Buchmann-Duck and Beazley, 2020; Folke et al., 2021). The health and balance of ecosystem cycles thereby fosters socio-ecological resilience and flourishing (Folke et al., 2021). However, there is currently a severe weakening and collapse of biodiversity and ecosystem functions due to human over-extraction of natural resources, habitat destruction, industrial pollution, deforestation, climate change, the introduction of invasive species and genetically modified organisms etc. (Haas et al., 2020; Murray et al., 2017; Springmann et al., 2018). In fact, the current rate of species extinction is 100 to 1000 times the baseline rate (Steffen et al., 2015) and only about 50% of the Earth's terrestrial natural ecosystems remain in relatively healthy conditions (Riggio et al., 2020). We are thus in the midst of what many scientists have called the "sixth mass extinction event" (Barnosky et al., 2011; Røpke, 2019).

1.3.3 Resource cycles of materials and energy

Resource cycles bring materials and energy to human economies. After being extracted, processed and consumed, resources are cycled through various recovery loops such as repair, reuse, remanufacture, recycle etc. (Antikainen et al., 2018; Ghisellini et al., 2016). At their end-of-use, resources are cycled back to nature either by being burnt and dissipated into the atmosphere, by being placed into landfills or by being thrown into the environment (Krausmann et al., 2018; Martinez-Alier, 2021a; Rammelt, 2020).

Waste that is not sustainably cycled can accumulate in natural ecosystems and cause a degradation of human and planetary health (Morseletto, 2020). This occurs when there is a lack of effective solid and liquid waste treatment and recovery or an excess of pollution (i.e. when pollution exceeds the ability of the biosphere to assimilate it or exceeds safe emission levels for human health) (Robèrt, 2002; Suárez-Eiroa et al., 2019). These cycles can also be disrupted by the over-extraction of renewable resources beyond their replenishing rate such as the overfishing of marine resources, the overdrafting of water resources, the unsustainable management of forests, or the over-tilling of agricultural soils (Rammelt and Crisp, 2014; Unruh, 2008; Velenturf and Purnell, 2021). Similarly, sustainability problems can arise when non-renewable resources like ores (iron, copper, nickel, aluminium etc.) and non-metallic minerals (marble, gravel, sand etc.) are over-extracted and not recycled back

3 It is worth noting that ecosystems in the deep sea, where no sunlight can penetrate, obtain energy from hydrogen sulfide near hydrothermal vents rather than from sunlight.

4 However, it is worth noting that natural ecosystems are not perfectly circular because available energy dissipates in each trophic level (typically 90% is thus "lost"). Thus, biological system cannot continuously cycle energy and materials without the continuous inflow of additional energy from the sun (Skene, 2018).

into the economy (Daly, 1996; Stahel, 2010; Suárez-Eiroa et al., 2019). Finally, unsustainable resource flows can arise when resources are lost due to mismanagement. This happens when resources are wasted before they are consumed due to losses in storage and transportation (Marín-Beltrán et al., 2022). Accounting for all of the above, the global economy currently sustainably cycles only about 8% of its total resource use (Haas et al., 2020; Haigh et al., 2021), humanity could thereby run into critical resource shortages and overshoot key ecosystem boundaries in the coming decades (Bihouix, 2014; Herrington, 2021; Turner, 2014).

1.3.4 Political cycles of power

Laws and institutions shape and determine how power circulates through human societies. Decisions and authority can thus flow from the top down or bottom up depending on the established governance models (Lawhon and Murphy, 2012). Different institutions, maintain a balanced flow in the distribution of power between the different branches of government (executive, legislative and judiciary) and between the different scales of government (municipalities, regional governments, national states etc.). Balance of power is also maintained in the cycles of power that occur during elections for local, regional, and national representatives. Power also flows between the public and private sectors beyond elections, with various lobbying mechanisms, multi-stakeholder platforms, participatory bodies and public-private partnerships shaping how policies are developed and implemented (Driessen et al., 2012). Unsustainable cycles of power can arise when citizens lose the ability to democratically control their state due to the power of wealthy economic "elites" or of entrenched political elites (or a mixture of both, as political and economic elites are often hard to distinguish from one another due to the many "revolving doors" between high level public and private institutions) (Frankel, 2018; Stiglitz, 2012). Many academics have argued that the balance of pollical power is currently under threat due to the large inequalities that have risen both locally and globally and due to the lack of meaningful citizen participation in decision-making through democratic institutions and processes (Löwy, 2011; Piketty, 2019; Sánchez-Cuenca, 2017). A broad range of mechanisms exist to maintain a democratic flow of power that benefits all citizens such as participatory budgeting systems, referendums, citizen assemblies, citizen juries, deliberative polling, elections etc. (Calisto Friant, 2019; Dryzek et al., 2019; Fishkin, 2018; Fung and Wright, 2001). These and other policies such as the respect of political and socio-economic human rights, the creation of fair and independent judicial systems, the promotion of free and plural media, etc. help in the creation of pluralist and inclusive institutions that ensure a fair, democratic and balanced flow of power within human societies (Acemoglu and Robinson, 2012).

1.3.5 Economic cycles of money and wealth

Monetary resources flow and cycle through an economy, continuously shifting hands between governments, firms, NGOS, individuals etc. This flow of wealth is a key element of an economy's resource provisioning and distribution system (Fanning et al., 2020; Røpke, 2016). When monetary wealth accumulates too much in certain hands, it can generate unsustainable inequalities that prevent the economy from running for the benefit of society as a whole (Jackson, 2021; Piketty, 2019; Scharmer and Kaufer, 2013). The same is true for wealth in the form of private property, especially private property in the means of production (ownership of companies, technologies, tools and natural resources) as well as the private property of land and housing (Felber, 2015).[5] When money and private property over-accumulate and stop cycling, this can create inequalities in a society's distribution of resources, which threaten the stability and effective functioning of its economy as well as the freedom of its citizens (Acemoglu and Robinson, 2012; Hickel, 2021; Kallis, 2019). Many researchers suggest this is currently the case as the top 10% of the global population own 76% of global wealth while the bottom 50% own just 2% (Chancel et al., 2022). Various policy mechanisms can be used to counteract this inequality and ensure that wealth is fairly and sustainably circulated throughout the economy. These policies include property taxes, inheritance taxes, and taxes on financial transactions as well as redistributive policies such as universal basic incomes, job guarantee programmes and the provision of free and quality public goods and services like housing, healthcare, education, water, energy, and social security (Cosme et al., 2017; T. Hartley et al., 2020; Piketty, 2019). In addition to this, democratic worker control over companies and workplaces through unions, cooperatives, and community-owned enterprises can help better distribute wealth within the economy (Bookchin, 1982; Felber, 2015; Roberts, 2017; Song, 2016).

1.3.6 Knowledge cycles of technology, information, and education

Modern civilizations are built upon the knowledge and technologies of over 300.000 years of human history. Our societies rest upon centuries of technical inventions from the wheel, and the printing press, to the windmill, and the internet. We also rely on spiritual, artistic, and social inventions such as philosophy, music, schools, and democratic institutions. The flow of human knowledge and technology through writing, education, travel, research, and storytelling can be seen as a major fuel for the development and progress of humankind through history (Stiegler and Ross, 2018). Yet, overly stringent patent and intellectual property laws, and the privatization and commodification of research, knowledge and technology can limit the ability of all humans to share and equally benefit from new technical and societal innovations (Frankel, 2018; Papanek, 1972; Zizek et al., 2008). The accumulation of patents and technologies in certain countries, companies, universities, or individuals can threaten the free and open sharing of ideas, which can prevent a fair and democratic balance of power between different peoples. Policies and practices that encourage open source and transparent sharing of information and technologies as well as free quality public education from pre-school to university can help circulate knowledge in more sustainable and inclusive manners (Kerschner et al., 2018; Vetter, 2018).

5 Many communist, socialist, and anarchist scholars, would rightly argue that any level of private accumulation and ownership of means of production inherently prevents a fair and sustainable circulation of wealth (Albert, 2021; Bellamy Foster et al., 2010; Bookchin, 1982; Harvey, 2012; Löwy, 2011).

Transdisciplinary teaching and research approaches such as participatory action research can also help democratise knowledge flows by empowering marginalized and vulnerable people in the creation, ownership and dissemination of knowledge (Escobar, 2018; Fals-Borda, 1987; Vermeulen and Witjes, 2020). This democratisation of knowledge cycles can also be achieved through pluriversal approaches to science that break the ivory tower of western academic disciplines and embrace other forms of knowledge-making and world-making such as indigenous education, technological and spiritual traditions (Kothari et al., 2019; Velasco-Herrejón et al., 2022).

1.3.7 Social cycles of care

Key cycles of care occur every day as people share love, affection, energy and time with their family, friends, and communities. These cycles of care are often invisible and un-valued in current societies, yet they are a fundamental cornerstone of human civilization that ensure the health and reproduction of life (Dengler and Lang, 2021; Di Chiro, 2019; Nirmal and Rocheleau, 2019). Care cycles are responsible for the well-being and education of children, the feeding and nourishing of most of humanity, the regeneration of vital ecosystems, the protection of biodiversity, the maintenance of people's physical and mental health etc. (Morrow and Davies, 2021; Pla-Julián and Guevara, 2019; Rogers et al., 2021). When these cycles of care stop by being commoditized, by neglect, by lack of free time, or by lack of funding for social services and safety nets; human societies can face major crises of socio-ecological health and wellbeing (Dengler and Lang, 2021; Helne and Hirvilammi, 2019; Phillips, 2020). Moreover, care is key for societal resilience towards disasters, strengthening social and community relations of care can thus be a central strategy to face the manyfold socio-ecological impacts of climate change and biodiversity loss, such as hurricanes, floods, mass migration, sea-level rise and heat-waves (IPCC, 2022).

1.3.8 Addressing all relevant cycles and flows with a holistic view of circularity

All of the above cycles are interrelated and should not be considered in isolation. This is shown in Figure 1.1 as all cycles overlap one another and influence each other in multiple ways (e.g. a failure in care cycles can cause a weakening of ecological cycles and vice versa). Moreover, various other social-ecological cycles have not been represented above as this is a simplification of complex planetary and societal structures. The main value of representing those seven cycles thus resides in helping us understand what "circularity" and "circular" flows can be about in relation to sustainability and human and planetary wellbeing. They help expand the imagination regarding what is and what isn't included as a "loop", "cycle", "circle", or "flow" when we talk of a "circular" economy and society. Moreover, these seven cycles are very much aligned with the well-recognized conceptions, and principles, of sustainability developed by Robèrt (2002) and by Herman Daly (1996). Robèrt describes a sustainable society as one where "nature is not subject to systematically increasing: 1. concentrations of substances extracted from the Earth's crust 2. concentrations of substances produced by society; 3. degradation by physical means; and in that society 4. human needs are met worldwide" (2002, p246). Similarly, Daly stipulates that sustainable development requires first that renewable resources are harvested at a rate below their regeneration rate; second, that waste emission rates are below the assimilative capacities of the ecosystems; and, third, that the rate of depletion of non-renewable resources, does not exceed the rate of creation of renewable substitutes (1996). Daly adds that "all economic and environmental decision-making should consider the well-being of future generations, and preserve for them the widest possible range of choices" (1996, p15).

A central point that can be drawn from the seven socio-ecological cycles described above and their relation to human and planetary wellbeing is that sustainability crises can arise if any of these cycles stop flowing. Excessive accumulation, unsustainable exploitation, lack of effective recovery, lack of sufficient redistribution or simply neglect can thereby lead to important sustainability problems and even a collapse of planetary functions and societal structures. Moreover, many academics have demonstrated that the current capitalist system is negatively impacting all these flows and cycles (Brand et al., 2021; Hickel, 2021; Rammelt, 2020). Capitalism can be described as a linear system that continuously generates waste in terms of social injustice, poverty, alienation, exploitation and conflicts over resources (Armiero, 2021; Biel, 2012; Marín-Beltrán et al., 2022) as well as waste in terms of environmental pollution, biodiversity reduction and disruption of biogeochemical flows and cycles (Mayumi and Giampietro, 2019; Rammelt, 2020; Spash, 2020)[6]. As Martinez-Alier points out, the growth-dependent nature of the global capitalist economy means that it depends on the continuous supply of raw materials and energy from "commodity extraction frontiers" and generates an endless supply of waste that it sends to "waste disposal frontiers" (Martinez-Alier, 2021a). This has created a global pattern of social and environmental injustice with countless ecological distribution conflicts throughout the world and strong global movements of popular resistance and revolt against the expansion of capitalist frontiers on human and natural ecosystems (Armiero, 2021; Biel, 2012; Martinez-Alier, 2021b)[7]. Poor communities, indigenous people, people of colour, women, LGBTI+ groups, and many more systemically marginalized people, are thereby often united in their common struggle against the socio-ecological impacts of this globalized economic system (Martinez-Alier, 2021a; Scheidel et al., 2020). This conflict costs the lives of over 250 environmental and human rights defenders every year (Font Line Defenders, 2020) and this tragic figure doesn't count the thousands more who die

6 Because of these socio-ecological impacts of the linear capitalist system, some scholars call it a social and environmentally entropic system (Biel, 2012; Giampietro, 2019; Martinez-Alier, 2021b, 2021a). Both social and environmental entropy can be understood as the application of the thermodynamic principle of entropy to our socio-ecological system. Entropy here is thus a measure of chaos, conflict, lack of diversity and disharmony. An increase in environmental entropy is thus a reduction of biodiversity, a reduction of available material and energy resources, greater pollution, lower resilience of ecosystems and a disruption of biochemical flows and cycles (Giampietro, 2019; Martinez-Alier, 2021b). An increase of social entropy means a increase of social injustice, unrest, poverty, exploitation, conflicts, violence and alienation while a reduction of social entropy entails greater peace, equity, solidarity, reciprocity, harmony, health, democracy and conviviality (Biel, 2012).

7 The environmental justice atlas counts over 3500 ecological distribution conflicts to date (see https://ejatlas.org/)

of hunger, lack of access to healthcare and sanitation, over-exposure to toxic pollution and many other so-called "externalities" of the global capitalist economy (every year over 9 million people die of hunger (Holmes, 2021), 2 million die due to work-related accidents and diseases (ILO, 2022) and over 8 million die due to air pollution (Vohra et al., 2021)).

As mentioned above, the idea of a CE has grown in the discursive sphere as a way to address the above sustainability challenges. Indeed, it is proposed as a new vision to reduce waste and resource scarcity by sustainably cycling materials and energy in our economies thanks to various value retention technologies and business models such as reduce, reuse, repair, remanufacture, recycle, re-mine etc. (Blomsma and Brennan, 2017; Ghisellini et al., 2016; Stahel, 2016). However, this mainstream vision of a CE only addresses the third of the seven cycles mentioned above ('the resource cycle') and partly addresses the first ('biogeochemical') and second ('ecosystem') cycles. Key social and political elements such as the democratization of power, the redistribution of wealth and the nurturing of caring activities, are thus typically absent from mainstream CE debates (Clube and Tennant, 2020; Genovese and Pansera, 2020; Moreau et al., 2017). There is also a significant lack of academic research on the social and political implications of CE and on the public policies to transition to a fair and sustainable circular future (Lazarevic and Valve, 2017; Millar et al., 2019; Temesgen et al., 2019). Although some social movements and academics have started to propose a "social CE" (Social Circular Economy, 2017), a "circular humansphere", (Schröder et al., 2020), a "careful circularity" (Morrow and Davies, 2021) or a "circular society" (Jaeger-Erben et al., 2021; Jaeger-Erben and Hofmann, 2020; Leipold et al., 2021; Melles, 2021) as a more inclusive and socially just approach to circularity, they remain a relatively marginal part of the academic and societal discourse on the topic.

It is also worth noting that the CE is often promoted as a vehicle to decouple economic growth from environmental degradation through the many eco-efficiency improvements it hopes to bring about in material and energy resource cycles (D'Amato et al., 2019; Giampietro and Funtowicz, 2020; Lazarevic and Valve, 2017). Yet, this growth-optimist approach to CE is quite problematic from a scientific perspective, as a significant amount of academic research has demonstrated that decoupling is neither happening nor likely to happen on a sufficient scale to prevent climate breakdown and biodiversity collapse (Haberl et al., 2020; Hickel and Kallis, 2019; Jackson and Victor, 2019; Parrique et al., 2019). In fact, research has shown that economic growth is deeply tied to energy and resource use, and it is the main driver for the continuous expansion of the commodity extraction and waste disposal frontiers (Giampietro, 2019; Marín-Beltrán et al., 2022; Martinez-Alier, 2021a; Rammelt and Crisp, 2014; Wiedmann et al., 2020). Hence, by focusing on economic growth, regardless of real planetary boundaries and limits, mainstream CE approaches currently lack a full understanding of the biogeochemical, ecosystem, and resource cycles described above.

All in all, mainstream CE discourse and research often lacks a holistic vision of both social and ecological cycles and remains attached to problematic assumptions about economic growth and decoupling. This technocentric discourse on CE presently dominates the discursive landscape and could end up replicating current patterns of social and environmental unsustainability and injustice (Genovese and Pansera, 2020; Mah, 2021; Martinez-Alier, 2021a). Addressing those research and conceptual gaps on CE is a timely endeavour now that the CE concept is still relatively young and remains in conceptual development and construction. It is thus still possible to challenge and enrich the discourse with different visions of what a CE is about and expand the imaginary of what a fair and sustainable circular society can look like. The debate on the conceptualization and future of the concept is a key academic and societal debate as any shape the concept takes now will influence how it is understood and implemented in the future. Despite this, there has been little research on the different and often contested discourses, governance processes and policy mechanisms guiding the transition to a circular economy and society.

1.4 Research question

This thesis seeks to address the above research gaps regarding the key social, political, and ecological implications of different CE policies and discourses. It thus aims to better synthesize, compare, and describe the plurality and diversity of visions on a circular economy and society. It does so by asking the following research question:

> *What are the main societal discourses and policies on the CE, how can they be critically analysed, compared, and understood, and what are their sustainability implications?*

With this question, this research seeks to map and contrast competing visions of a circular future so the diversity of the topic can be better understood. By acknowledging the whole landscape of alternative CE proposals, this research opens the floor for an open dialogue between different circular discourses and hopes to expand the academic and societal debate on the topic. Ultimately, by answering the above research question, this thesis seeks to foster a democratic cross-pollination of ideas, policy options, strategies, practices, and solutions, and thereby enrich the imaginary of what a circular society can look like.

To answer the research question, this thesis employs an interdisciplinary mixed-method approach including critical literature review, content analysis, text-mining, and a Q-method survey (Brown, 1993).[8] Case studies are European Union (EU) CE policies, Dutch CE policies for plastics and tyres, as well as the CE action plans of 3 European cities (Copenhagen, Amsterdam, and Glasgow). The choice of the EU as the centre of this thesis's set of case studies stems from the central role that the EU has played in the conceptual development

8 It is worth noting that, originally, the thesis planned to use transdisciplinary and participatory research methods which directly include societal actors in the co-construction of scientific of knowledge (Lang et al., 2012). However, the COVID-19 pandemic, and its implications regarding in-person meetings, events, and workshops, which are central to transdisciplinary methods, forced us to change methodological directions.

and popularity of the CE concept. Indeed, since the enactment of the CE Action Plan in 2015, the EU and its various Member States have been global frontrunners in the adoption of CE policies (Colombo et al., 2019; Fitch-Roy et al., 2020; Lazarevic and Valve, 2017; McDowall et al., 2017; Wuttke, 2018). Considering the key position of the EU, which is often seen as an innovator and agenda-seter for global environmental policy, its interpretation of the concept will likely have a strong influence on how other countries and actors understand and implement the CE (Fitch-Roy et al., 2020; Knill et al., 2020; Rijnhout et al., 2018). By analysing how key policy actors in the EU are understanding and implementing the CE, this research can thus uncover what visions dominate the policy debate and discuss what this means for the future of the concept and its social and environmental implications. It can also help identify key gaps and limitations in current CE approaches and propose solutions from a plurality of alternative circular visions and proposals.

This thesis adopts the definition of discourse established by Hajer and Versteeg as "an ensemble of ideas, concepts and categories through which meaning is given to social and physical phenomena, and which is produced and reproduced through an identifiable set of practices" (2005, p.175). Discourses enable and constrain how political and societal actors understand and act on particular physical or social phenomena, shaping what can and cannot be thought about and what range of policy options are possible (Dryzek, 2013; Hajer and Versteeg, 2005). Various discourses can exist at one point in time; however, they often compete with one another, and one or a few discourses typically dominate whilst others are suppressed. Discourses are thus rooted in politics and power, as different actors often compete for their discourse to become dominant and shape policy-making and societal imaginaries (Leipold et al., 2019).

Public institutions can also decide to replicate and enact a specific discourse through their actions and communications, thereby shaping the societal understanding of a specific topic. The growth-based narrative of economic and societal progress, for example, is a strong policy discourse that has shaped societal perceptions and understanding of GDP growth and its socio-ecological benefits and impacts (Jackson, 2021; Latouche, 2009). An institution's policy actions can also be different from its discourse on a topic, revealing a form of "organizational hypocrisy" (Knill et al. 2020). This is often called greenwashing or even "circular-washing" (Hofmann and Jaeger-Erben, 2020), as it allows an institution to adopt a progressive discourse to improve its societal image, all while taking few or no tangible actions and risks to implement this vision. This thesis will seek to unpack these complexities in the interaction between policy and discourse surrounding the CE transition.

All in all, by shaping the nature of public policy, discourses can shape the future of our societies. Discourses define the range of futures that are available to us as well as our understanding of what futures are deemed possible, reasonable, feasible and desirable (Polak, 1973). The control and use of different discourses has shaped human history from the construction of the first pyramids and cities to the development of monotheistic religions and the creation of nation-states (Harari, 2014). Discourses can define and frame the socio-political visions that humankind decides to work and fight for. The control and development of discourses is thus often an arena of power struggles and has shifted hands through history from kings to priests to bourgeois capitalists (Piketty, 2019). Understanding the major ideas and discourses of our time and who is controlling and framing them is thus essential to better understand the shape of our present time and of our common future. This is especially important for discourses surrounding the socio-ecological transition, which is arguably the greatest challenge humanity faces in the 21st century, and for which the CE is a key element of the discursive debate (von Weizsäcker and Wijkman, 2017). By untangling the various discourses and policies surrounding the CE transition, this thesis hopes to address these crucial questions and contribute to our understanding of social and environmental change.

1.5 Thesis structure

This thesis starts by developing a discourse typology that serves as a conceptual framework to analyse and compare the diversity and complexity of different CE visions both in academic literature and in societal practice (chapter 2). Chapter 3 then constitutes a first exploratory case study to better understand government and industry approaches to CE through an analysis of the Dutch extended producer responsibility (EPR) system for end-of-life passenger car tyres. By analysing this well-established and well-recognized system of resource governance, this exploratory case study allows us to build a solid understanding of how the CE is currently understood and implemented. Chapter 3 was written at the same time as chapter 2. It, therefore, does not use the conceptual framework built in chapter 2 but rather an earlier one developed by Rieke et al. (2018). The next chapters focus on applying the discourse typology developed in chapter 2 to different case studies including EU policies (chapter 4), plastic packaging (chapter 5), and European cities (chapter 6) (see Figure 1.2). The wide range and diversity of case studies allow for a broad understanding of CE and its implementation in different sectors (plastics and tyres) and political scales (city, national and international). In Chapter 7 (conclusions) research results, recommendations and insights are reflected upon, and their social and academic relevance is discussed and highlighted.

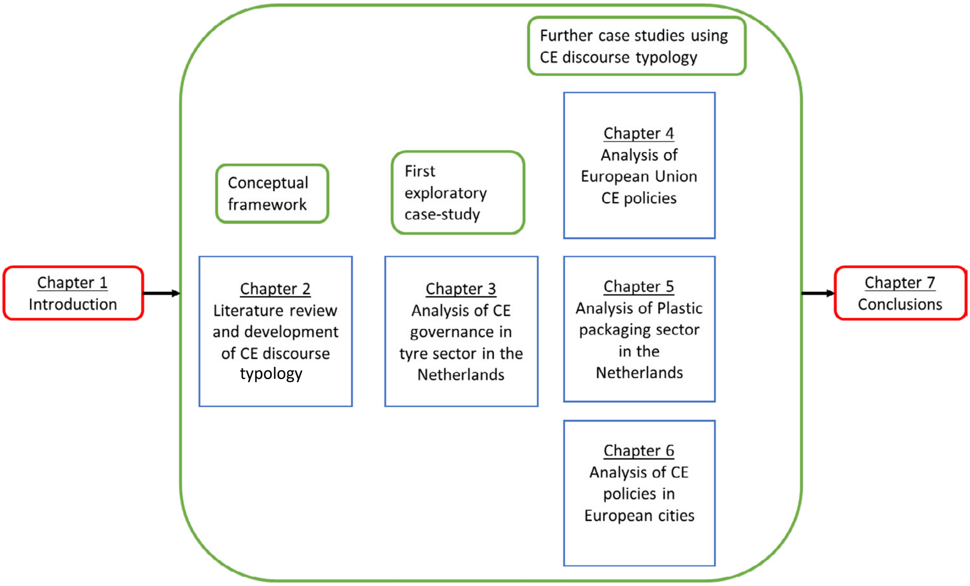


FIGURE 1.2 | Thesis structure.

1.5.1 Chapter 2: A typology of circular economy discourses: navigating the diverse visions of a contested paradigm

This chapter establishes a conceptual framework that will constitute the backbone of the thesis and that will guide the analysis of the case studies in chapters 4, 5 and 6. It does so by answering the following research question: *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 this chapter conducts a critical literature review of the CE concept. This literature review led to the development of a comprehensive timeline of circularity thinking, which identifies and conceptually classifies 72 different CE-related concepts from the Global North and South alike (such as Gandhian and steady-state economics, buen vivir, doughnut economics and degrowth). This literature review also led to the development of a typology of circularity discourses. The typology classifies and describes circularity visions according to their position on fundamental social, technological, political, and ecological issues. This research helps better synthesize, compare, and navigate the plurality and diversity of circular discourse through history. It thereby addresses the how part of this thesis research question (*how [CE discourses] can be critically analysed, compared, and understood*) and it provides the basis for a more inclusive and comprehensive discussion on the topic. This chapter can be useful for academics and practitioners that seek to enrich their understanding of the CE concept, its history and its diversity.

1.5.2 Chapter 3: How circular is your tyre: experiences with extended producer responsibility from a circular economy perspective

This chapter is a case study of the Dutch EPR system for end-of-life passenger car tyres, a well-established CE policy, that is often seen as a best practice for sustainable resource recovery and environmental governance. This case study analyses how the CE is currently understood and implemented in the Netherlands and how it can be improved from a systemic CE perspective. This chapter answers the following research question: *how effectively do current ERP systems function from the current ambitions of CE?* To answer this question this chapter uses a qualitative approach, using a combination of stakeholder interviews and an analysis of EPR policy and reporting documents. This research assesses the governance of this sector and reflects on the existing system, including its value retention outcomes and its sustainability implications. The analysis reveals that the current EPR system focuses on technological solutions and end-of-pipe approaches resulting in limited circularity and sustainability outcomes despite high material recovery levels. The current system also depends on the export of end-of-life tyres, which can lead to negative social and environmental impacts. The chapter develops recommendations to address these issues such as establishing a more transparent, democratic, and inclusive governance system and focusing more on higher value-retention options such as refuse, reduce and reuse strategies. By critically analysing the policies and governance of the Dutch EPR system, this chapter reveals the underlying technocentric discursive vision behind this EPR system as well as the sustainability implications that this approach has. It hence contributes to answering the main research question of this thesis. This chapter constitutes a first exploratory case study to better understand government and industry approaches to CE. It, therefore, does not directly use the circularity discourse typology developed in chapter 2, but rather an earlier classification of CE discourses developed by Reike et al., (2018), which the typology further develops.

1.5.3 Chapter 4: Analysing European Union circular economy policies: words versus actions

This chapter uses the circularity discourse typology developed in chapter 2 to analyse the CE discourse and policies of the EU, and particularly the Junker Commission (2014-2019), which enacted the CE action plan in 2015 and its related directives and regulations. The research question asked by this chapter is: *what discourse of the CE is advanced by the policies of the Junker Commission (2014-2019), what sustainability implications does it have and what alternative policies from the perspective of other circularity visions could be recommended?* To answer this question this chapter uses a combination of qualitative and quantitative research methods including content analysis, keyword mining and policy analysis. The chapter reviews the complex set of concrete CE policies and actions adopted by the EU and compares them to the EU's discourse on the topic. Results evidence a dichotomy between words and actions, with a discourse that is rather holistic, while policies focus on "end of pipe" solutions and do not address the many socio-ecological implications of a circularity transition. Several actions are then recommended to tackle the systemic challenges of a circular future from a plural perspective. This chapter contributes to answering the main research question of the thesis by uncovering the circularity discourse proposed by the EU and unravelling its sustainability implications. The insights and recommendations developed by this chapter can help both practitioners and academics seeking to improve CE understanding and policymaking at the international and national scales.

1.5.4 Chapter 5: Transition to a sustainable circular plastics economy in the Netherlands: discourse and policy analysis

This chapter examines the Dutch CE strategy for plastic packaging using the circularity discourse typology developed in chapter 2. It does so by asking the following research question: *What are the main discourses in the transition towards a sustainable circular plastics economy in the Netherlands and what implications and recommendations can be drawn from it?* The methods include a mix of media analysis, policy analysis, semi-structured interviews, and surveys using Q-methodology. Results indicate that there is a dominance of technocentric imaginaries, and a general lack of discussion on holistic and transformative visions, which integrate the full social, political, and ecological implications of a circular future. To address those challenges, this chapter proposes many policy recommendations which can help both academics and practitioners better understand and implement the transition toward a sustainable circular plastics economy. This chapter contributes to answering the main research question of this thesis by revealing the underlying discourse behind the Dutch plastic packaging system and its key sustainability implications. The results from this chapter also help build a more democratic and diverse implementation of circular policies and strategies.

1.5.5 Chapter 6: Sustainable circular cities: analysing urban circular economy policies in Amsterdam, Glasgow and Copenhagen

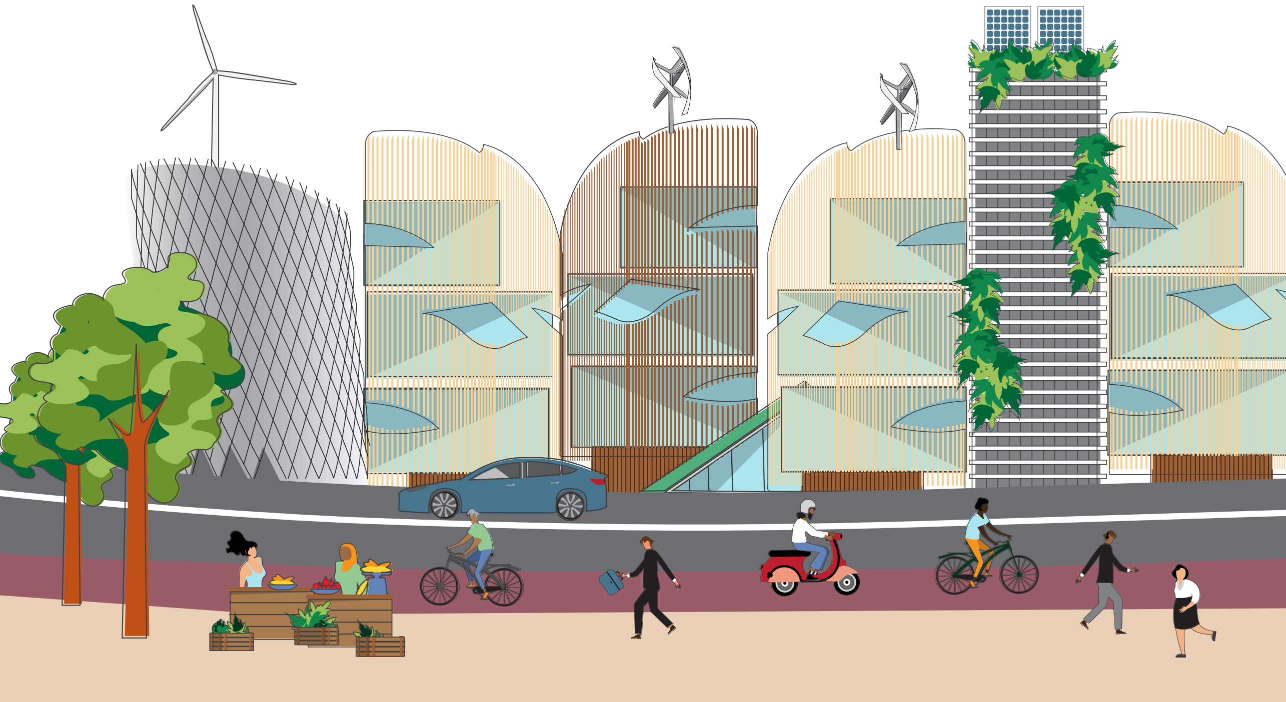
This chapter uses the circularity discourses typology developed in chapter 2 to analyse CE policies at the city level. It does so by answering the following research question: *how can urban circularity policies and discourses be critically analysed and compared, and what discourse is advanced by different circular city policies in Europe?* To answer this question, this chapter conducts a critical literature review of academic research on CE policies at the city level to develop a new conceptual framework. This framework is then used to critically analyse and compare the CE policies of 3 European cities at the forefront of the CE transition: Glasgow, Amsterdam, and Copenhagen. Results show that, while the three cities take a different approach to CE and its social implications, the three cities share an optimist approach to technology and economic growth. Various policy recommendations to improve CE implementation at the city scale are proposed to address the weaknesses of their CE policies in terms of social justice, growth dependence, and democratic inclusiveness. This chapter contributed to answering the main research question of this thesis by uncovering the underlying discourse behind circular policies at the city level and analysing their key sustainability implications. Results from this chapter are valuable for practitioners and academics who are looking to improve urban CE policy development and implementation.

Chapter 2

A Typology of Circular Economy Discourses: Navigating the Diverse Visions of a Contested Paradigm

This chapter is based on Calisto Friant, M., Vermeulen, W. J., & Salomone, R. (2020). A typology of circular economy discourses: Navigating the diverse visions of a contested paradigm. Resources, Conservation and Recycling, 161, 104917. https://doi.org/10.1016/j.resconrec.2020.104917

An earlier version of this chapter was presented at the 25th International Sustainable Development Research Society (ISDRS) Conference in Nanjing, China on the 27th of June 2019 and was published in its proceedings with the following title: "advancing a critical research agenda on the circular economy".



Abstract

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.

Graphical Abstract

		Approach to social, economic, environmental and political considerations	
		Holistic	**Segmented**
Technological innovation and collapse	**Optimist**	**Reformist Circular Society** • *Assumptions:* reformed capitalism is compatible with sustainability and socio-technical innovations can enable eco-economic decoupling . • *Goal:* economic prosperity and human well-being within the biophysical boundaries of the earth. • *Means:* technological breakthroughs and social innovations that benefit humanity and natural ecosystems.	**Technocentric Circular Economy** • *Assumptions:* capitalism is compatible with sustainability and technological innovation can enable eco-economic decoupling to prevent ecological collapse. • *Goal:* sustainable human progress and prosperity without negative environmental externalities. • *Means:* economic innovations, new business models and unprecedented breakthroughs in CE technologies.
	Sceptical	**Transformational Circular Society** • *Assumptions:* capitalism is incompatible with sustainability and socio-technical innovation cannot bring absolute eco-economic decoupling to prevent collapse • *Goal:* a world of conviviality and frugal abundance for all, while fairly distributing the biophysical resources of the earth. • *Means:* complete reconfiguration of the current socio-political system and a shift away from productivist and anthropocentric worldviews.	**Fortress Circular Economy** • *Assumptions:* there is no alternative to capitalism and socio-technical innovation cannot bring absolute eco-economic decoupling to prevent collapse . • *Goal:* maintain geostrategic resource security in global conditions where widespread resource scarcity and human overpopulation cannot provide for all. • *Means:* innovative technologies and business models combined with rationalized resource use and strict migration and population controls.

2.1 Introduction

The Circular Economy (CE) has become a "go-to concept" that has caught the attention of all sectors of society in 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)[9].

Overall, the CE concept is viewed as a promising idea and ideal that has much to bring towards addressing the 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 4,900[10]. 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 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 of 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).

9 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.

10 Based on SCOPUS search for "circular economy" (abstract, keyword, title) search conducted on the 11th of November 2019.

Some authors argue that those conceptual limitations are not important for practitioners, who 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, and 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 chapter develops the first 2x2 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 chapter thus builds and expands on the work of those previous authors to fill this research gap and develops a discourse typology which contributes toward 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 chapter thus not only fills a literature gap on CE discourse analysis[11] 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).

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

The chapter is structured as follows: first, it describes the research methods (section 2.2). It then critically reviews the challenges of the CE concept (section 2.3.1) and establishes a comprehensive historical timeline of circularity thinking (section 2.3.2). The chapter builds on these findings to differentiate circularity discourses based on the extent to which they address the identified challenges (section 2.4.1). 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 2.4.2). Finally, a discussion section (2.5) reflects on the conceptual and methodological implications of this research.

2.2 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 chapter was built based on a critical literature review[12], 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)[13].

This chapter 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 2.4.2 (see Figure 2.1).

12 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, p335-336)

13 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).

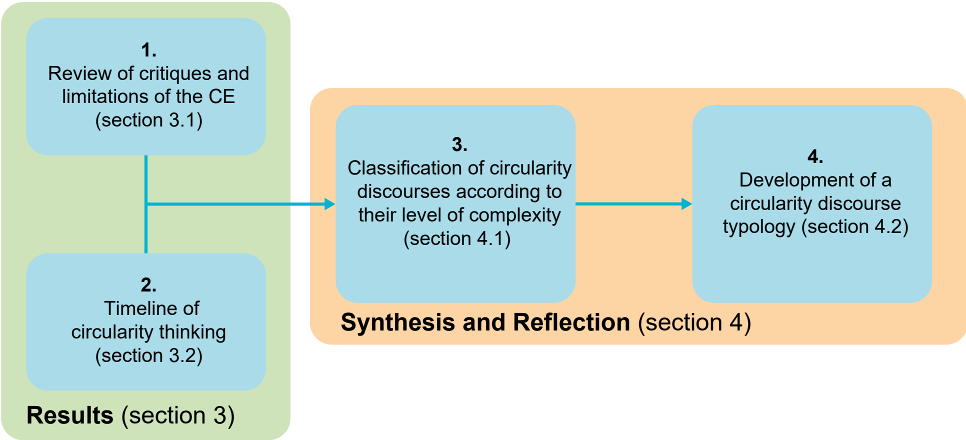


FIGURE 1.1 | Main steps in research methods.

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), 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.

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 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 (Figure 2.3).

The third step is a classification of circularity discourses according to their level of complexity (Table 2.1), meaning the extent to 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 between the various concepts presented in the timeline.

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 2.1). Different 2x2 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 (Figure 2.3). 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 at an academic conference and three academic workshops to test and improve it[14]. These workshops involved around 15 to 25 academic participants and allowed

14 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.

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 (Figure 2.3) as well as a list of 120 definitions of the CE[15] to evaluate where the current and past circularity debates stand.

2.3 Results

2.3.1 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

<u>Challenge 1: Systemic thinking on entropy, growth, capitalism and decoupling</u>

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., 2018a).

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

15 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.

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[16] (World Bank, 2022), capping material resource use has critical geopolitical dimensions and necessitates an essential reconsideration of normative questions regarding global justice, wellbeing and worldwide wealth redistribution (Arnsperger and Bourg, 2017; Bengtsson et al., 2018; Schröder et al., 2019a).

Furthermore, there is a lack of 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 sectors 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[17] (Arnsperger and Bourg, 2017; Audier, 2019; Kallis et al., 2018; Latouche, 2009).

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 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 on 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 a fully renewable energy grid will require a large number of material resources to build the new infrastructure such as wind turbines, solar panels,

16 Figure for 2015 considering a World Bank global aggregation measure that uses 2011 PPP and $5,50/day poverty line (World Bank, 2022).

17 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).

smart grids, electric cars, trains and buses etc. (Moreau et al., 2019; Reuter et al., 2019). This will inevitably increase the 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 toward zero-carbon circular economies (Bleischwitz and Miedzinski, 2018).

The third dimension to the abovementioned resource nexus between materials and energy is biodiversity[18]. A zero-carbon CE can lead to increased demand for natural resources such as wood, bio-fuels, bio-polymers, 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 (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 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

18 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.

(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; Hickel and Kallis, 2019; Nieto et al., 2019). The interactions between energy, biodiversity and material resources are graphically represented in Figure 2.2.

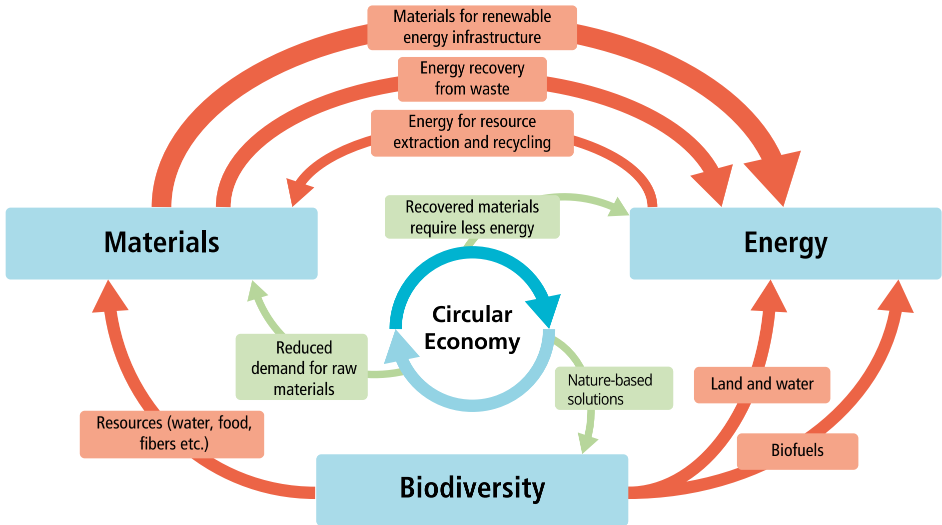


FIGURE 2.2 | Interactions of the Energy, Materials, Biodiversity Nexus (synergies are marked in green arrows, interactions with possible trade-offs are marked with red arrows).

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 lead 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 for 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 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-oriented 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).

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 regarding 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 4,901 articles on the CE: 2,316 are in environmental sciences, 1,753 are in engineering, 1,191 are in energy sciences, and only 804 are in social sciences or humanities)[19]. 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.

19 Based on a Scopus search for "circular economy" (abstract, keyword, title) conducted on the 11th of November 2019.

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 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 of a sustainability transition that does not sufficiently include social justice elements (Deléage, 2019; Laurent, 2019).

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 sustainable socio-economic structures which are compatible within the earth's system boundaries. Academics have indeed found core synergies between these concepts and degrowth can especially 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 into the first and most important “loops” in the CE value-retention hierarchy: refuse, reduce, reuse and repair (Reike et al., 2018a), all of which can lead to the sustainable slowing of resource cycles (Homrich et al., 2018).

2.3.2 Timeline of circularity thinking

A timeline of 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 Figure 2.3. 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. Figure 2.3 thus allows us to better situate the concept, both in its rich historical origins and in its complex theoretical diversity. This helps illustrate the manifold conceptualizations of circularity as well as the reformist vs transformational circularity schools of thought, which shape the current debate on the topic (Reike et al., 2018a). The 72 concepts in this timeline are further analysed in sections 2.4.1 and 2.4.2 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" (D. 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 great attention to all the issues discussed in section 2.3.1, 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., 2018a). This is thus when the first waste management and recycling systems were developed for various waste streams (Reike et al., 2018a; Takahashi, 2020). These concepts were mostly focused on specific technological innovations and thus didn't address the main challenges evidenced in section 2.3.1.

	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**		
			First holistic Circularity frameworks	**New holistic Circularity views**	**Transformational views of Circularity**	**Non-western visions of Circularity**
Gandhian economics (Kumarappa, 1945)	Waste-Water Treatment (Holcomb,1970)	Industrial Ecology (Frosch and Gallopoulos, 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 Economics of the Coming Spaceship Earth (Boulding, 1966)	Solid Waste Management and Recycling (Levick and Davies, 1975)	Circular Economy (Pearce and Turner, 1989)	Regenerative design (Lyle, 1994)	Material Efficiency (Allwood *et al.*, 2011)	Degrowth (Latouche, 2009)	Ubuntu (Shumba, 2011)
The tragedy of the Commons (Hardin, 1968)	Bio-Digestion (Hughes, 1975)	Eco-design /Design for environment (Ryan *et al.*, 1992)	Natural Capitalism (Hawken *et al.*, 1999)	Third Industrial Revolution (Rifkin, 2013)	Eco-socialism (Löwy, 2011)	Ecological Civilization (Zhang *et al.*, 2011)
The Population Bomb (Ehrlich, 1968)	Energy Recovery (Boyle, 1977)	Cyclic Economy (Tibbs, 1993)	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 entropy law and the economic process (Georgescu-Roegen, 1971)		Industrial Metabolism (Ayres and Simonis, 1994)	Cyclical Economy (Young *et al.*, 2001)	Regenerative Capitalism (Fullerton, 2015)	Transition design (Irwin, 2015)	Suma Qamaña / Vivir Bien (Artaraz and Calestani, 2015)
The Closing Circle (Commoner, 1971)		Cleaner Production (Baas, 1995)	Materials Matter (Geiser, 2001)	Sharing Economy (Frenken, 2017)	Economy for the Common Good (Felber, 2015)	Buddhist, Confucian and Taoist ecology (Arler, 2018)
Social Ecology (Bookchin, 1971)		Reverse Logistics (Rogers and Tibben-Lembke,1998)	Cradle to Cradle (McDonough and Braungart, 2002)	Doughnut Economics (Raworth, 2017)	Post-growth (Jackson, 2016)	Radical Pluralism / Pluriverse (Kothari *et al.*, 2019)
Limits to Growth (Meadows et al., 1972)		Eco-industrial parks and networks (Côté and Cohen-Rosenthal, 1998)	The Natural Step (Robert, 2002)	Symbiotic Economy (Delannoy, 2017)	Permacircular Economy (Bourg, 2018)	
Ecological Design (Papanek, 1972)		Biomimicry (Benyus, 1998)	The Biosphere Rules (Unruh, 2008)	Social Circular Economy (Social Circular Economy, 2017)	Voluntary Simplicity (Trainer and Alexander, 2019)	
Small is Beautiful (Schumacher, 1973)		Product Service System (Goedkoop *et al.*, 1999)	Performance Economy (Stahel, 2010)	Spiral Economy (Ashby *et al.*, 2019)	Convivialism (Caillé, 2019)	
Conviviality (Illich, 1973)		Extended Producer Responsibility (Lindhqvist, 2000)		Coviability (Barrière et al., 2019)		
Steady-state economics (Daly, 1977)		Industrial Symbiosis (Chertow, 2000)				
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)						
Overshoot (Catton 1980)						

FIGURE 2.3 | Timeline of Circularity Concepts[20]

20 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. An interactive version of this timeline with additionally suggested concepts is available in the following web-page: https://cresting.hull.ac.uk/impact/circularity-timeline/

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., 2018a). 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 2.3.1, 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; Caillé, 2019; Kothari et al., 2014; Latouche, 2018; Trainer and Alexander, 2019). Both discourses 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 of Calisto Friant et al. (2020) for more details on each concept in the timeline).

2.4 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 2.3.1 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 2.4.1). This leads to the circularity discourse typology which allows for a clearer differentiation, navigation and comprehension of this contested paradigm (section 2.4.2).

2.4.1 Classification of circularity discourses according to their level of complexity

Table 2.1 shows the different levels of complexity of circularity discourses depending on the extent to which they address the challenges reviewed in section 2.3.1:

- 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)[21] 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 were 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 (Figure 2.3) fits.

21 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 2.1 | 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

2

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 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 ensuring 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

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 sustainable loops, but also wealth, knowledge, technology and power are circulated and redistributed throughout society (see Figure 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 to 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 the term circularity to comprehensively include all its historically related concepts and ideas (as seen in Figure 2.3). Considering the importance of "policy labels, keywords and framing" for sustainability transitions (Silva et al., 2016, p224), these differentiations can help acknowledge and address the complex ecological, sociological and political implications of a circular future.

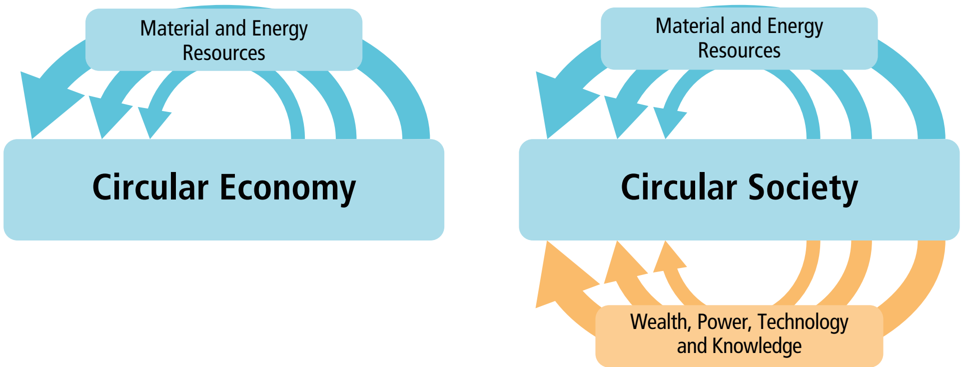


FIGURE 2.4 | Conceptual Differentiation between Circular Economy and Circular Society.

2.4.2 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 2.3. 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 of the fragility of nature to the divide between cultural rationalities This leads to four core environmental discourses: fatalists, 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 cutbacks in consumption to stay within planetary limits and wizards who propose optimistic technological solutions. Moreover, Audet (2016) distinguishes between localist and technocentrist transition discourses, the first being focused on scientific innovation, and the latter, 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 Figure 2.3. The typology of CE discourses presented in Figure 2.5 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 2.4.1 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 2.1). 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)[22] (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.

		Approach to social, economic, environmental and political considerations	
		Holistic	**Segmented**
Technological innovation and ecological collapse	**Optimist**	**Reformist Circular Society** • *Assumptions:* reformed form of capitalism is compatible with sustainability and socio-technical innovations can enable eco-economic decoupling to prevent ecological collapse. • *Goal:* economic prosperity and human well-being within the biophysical boundaries of the earth. • *Means:* technological breakthroughs, social innovations and new business models that improve ecological health, resource security, and material prosperity for all.	**Techncentric Circular Economy** • *Assumptions:* capitalism is compatible with sustainability and technological innovation can enable eco-economic decoupling to prevent ecological collapse. • *Goal:* sustainable human progress and prosperity without negative environmental externalities. • *Means:* economic innovations, new business models and unprecedented breakthroughs in CE technologies for the closing of resource loops with optimum economic value creation.
	Sceptical	**Transformational Circular Society** • *Assumptions:* capitalism is incompatible with sustainability and socio-technical innovation cannot bring absolute eco-economic decoupling to prevent ecological collapse. • *Goal:* a world of conviviality and frugal abundance for all, while fairly distributing the biophysical resources of the earth. • *Means:* complete reconfiguration of the current socio-political system and a shift away from productivist and anthropocentric worldviews to drastically reduce humanity's ecological footprint and ensure that everyone can live meaningfully, and in harmony with the earth.	**Fortress Circular Economy** • *Assumptions:* there is no alternative to capitalism and socio-technical innovation cannot bring absolute eco-economic decoupling to prevent ecological collapse. • *Goal:* maintain geostrategic resource security and earth system stability in global conditions where widespread resource scarcity and human overpopulation cannot provide for all. • *Means:* innovative technologies and business models combined with rationalized resource use, imposed frugality and strict migration and population controls.

FIGURE 2.5 | Circularity discourse typology.

22 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).

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 R3 repair, R4 refurbish, R5 remanufacture, R6 re-purpose, and R7 recycle. 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 with Dryzek's (2013) sustainability category of discourses. The name of this discourse type derives from Reike et al.'s (2018) reformist CE distinction combined with the circular society concept as described in section 2.4.1.

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 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.'s (2018) transformational CE distinction combined with the circular society concept as described in section 2.4.1.

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 2.4.1.

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 types of discourses have also historically existed in authoritarian regimes such as 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"[23], 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 p18). 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.

Table 2.2 presents the position of each concept from the timeline in relation to the discourse typology[24]. The most widespread discourse in the literature is Transformational Circular Society (42% of reviewed concepts), followed by Reformist Circular Society (28% of reviewed concepts), and Technocentric Circular Economy (26% of reviewed concepts) and then by 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

23 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, p99) this crisis-driven narrative have been used to control natural resources and commodify nature (Fletcher, 2019, 2012).

24 It is worth noting that many concepts have elements of various different circularity discourse types and are thus sometimes hard to place in a single area. Moreover, different authors might write about these concepts in different ways and with different interpretations. Table 2.2 thus puts these concepts where they fit the most, but some concepts are somewhat in between, such as Doughnut Economics and Eco-systems economy which sit between TCS and RCS.

TABLE 2.2 | 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 (D. 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 1.0concepts:** 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)

Society (12%), 3 in Fortress Circular Economy (2.5%), and 2 in the Transformational Circular Society (1.5%) (see supplementary materials of Calisto Friant et al. (2020) 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 the significant literature on other circular discourses. This is in line with the results of D'Amato et al. (2019), which found that academics had more degrowth or post-growth oriented perspectives 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.

2.5 Discussion

This chapter's approach involved first investigating the current limits of the discussion on the CE (section 2.3.1), and then recognising that the term is actually much older and much more diverse than what is usually conceived (section 2.3.2). 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 2.4). This section reflects on the conceptual and methodological implications of this research.

2.5.1 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 2.3.1 (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 2.4.1 (please see table 2.1).

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 to 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 2.3, as they do not address issues of entropy, planetary limits, rebound effects, and the social implications of circularity, and only partly deal with challenge 2 on the resource nexus. They thus fall within complexity levels 1 to 3 of Table 2.1, 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 2.1 and might be unappealing to social movements with plural and ecocentric perspectives.

Transformational Circular Society discourses address all the 5 challenges identified in section 2.3 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 2.1. 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 to 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 un-idealistic 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"[25] (Fisher, 2009). Yet, these discourses

25 Fisher attributes this quote to both Fredric Jameson and Slavoj Žižek (Fisher, 2009)

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, p14).

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 mechanisms 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).

2.5.2 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 2.1 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[26], and various circularity positions from the public and public sectors were reviewed (E.g., Ellen MacArthur Foundation and McKinsey, 2015; 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 chapter. 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 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.

26 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

2.6 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 chapter 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 chapter 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.

Chapter 3

How Circular Is Your Tyre: Experiences With Extended Producer Responsibility From a Circular Economy Perspective

This chapter is based on Campbell-Johnston, K., Calisto Friant, M., Thapa, K., Lakerveld, D., Vermeulen, W.J.V., (2020) How circular is your tyre: Experiences with extended producer responsibility from a circular economy perspective. Journal of Cleaner Production. 270, 122042. https://doi.org/10.1016/j.jclepro.2020.122042

An earlier version of this chapter was presented at the 2019 international Sustainable Development Research Society Conference in Nanjing China on the 27th of June 2019.

Abstract

The circular economy (CE) emphasises closing material loops to retain material value. The current practice of tyre recycling in the Netherlands, through a system of extended producer responsibility (EPR), appears an overwhelming success, with claims of 100% recovery. Yet, there is limited critical understanding regarding the system's circularity, considering alternative value retention options and resource recovery outcomes. This study analyses this Dutch tyre EPR system and reflects on how it can be improved from a systemic CE perspective. It uses a qualitative case study approach, using interviews and a review of policy, legal and EPR reporting documents. This chapter assesses the governance of this sector and reflects on the existing system, including its circularity and value retention outcomes. Our analysis reveals seven central issues concerning how the EPR system currently functions, resulting in limited circularity and sustainability outcomes, despite high material recovery levels. To address these issues we recommend the continuous improvement of recovery and sustainability targets beyond a single product life cycle, a more transparent and inclusive governance system, as well as a greater focus on sufficiency strategies, e.g. design for durability and a broader transformation of transport models. This chapter adds a practical understanding of the capacity of EPR to contribute to CE.

3.1 Introduction

National, regional and local governments have recently begun to present the concept of circular economy (CE) as a new pathway to sustainability and economic prosperity. The championing of this inconsistent and contested concept (cf. Korhonen et al., 2018b) comes amid increasing concerns over resource depletion, waste generation and the potential overshoot of planetary boundaries induced by human activities on the biosphere (Henckens et al., 2014; Rockström et al., 2009a). CE is broadly argued to meet these emerging challenges through slowing, closing and narrowing resource loops, i.e. maximising the functional utility of materials and energy (Geissdoerfer et al., 2017; Stahel, 2010). CE theoretically builds upon and goes beyond earlier measures of waste valorisation and cleaner production initiatives to an integrated systems perspective addressing both production and consumption practices (Ellen MacArthur Foundation, 2013; Vermeulen et al., 2018).

The European Commission (EC) frames CE in conjunction with economic opportunities stating that "[CE] will boost the [European Union] EU's competitiveness by protecting businesses against scarcity of resources and volatile prices, helping to create new business opportunities and innovative, more efficient ways of producing and consuming" (EC, 2013, p. 1). National governments have similarly outlined specific strategies, including the Netherlands, France and Italy; with the Netherlands setting an initial target of 50% less primary material use by 2030 (Ministry of Infrastructure and Environment and Ministry of Economic Affairs, 2016b). Whilst the environmental and economic concerns underpinning CE might be perceived as new, the means through which they are being addressed are manifesting through more conventional or longer-standing organisational practices, including increased recycling targets, waste legislation and extended producer responsibility (EPR) commitments (Milios, 2018).

Scholars have devoted much time to analysing new business models and strategies related to CE (cf. Bocken et al., 2016; Lüdeke-Freund et al., 2019). Yet, there is also a need to reflect and examine these older CE initiatives and practices to understand their suitability and capacity to facilitate and address the emerging societal concerns evidenced within the existing CE debate.

One such system is EPR, which has been collectively and voluntarily adopted in many EU member states for different products, including passenger car tyres (EC, 2014). EU member states are free to choose how to organise the collections and treatment of tyres, which are reported to the European Tyre and Rubber Manufacturers Association (ETRMA); most member states have adopted EPR systems, which have successfully recovered high quantities of used tyres (recovery rates for end-of-life (EOL) tyres in Europe are above 90% since 2007) (ETRMA, 2017; ETRMA, 2018). However, despite such high levels of recovery, there is little direct substitution (closed-loop), i.e. new tyres have a low content of recycled rubber (EC, 2017). Indeed, up to 50% of collected tyres are burned – usually, for energy recovery (Scott, 2015) – a problem further compounded as natural rubber is a designated critical raw material (EC, 2017). Whilst the technological feasibility of such direct material substitution through devulcanization is being debated and explored (Myhre et al., 2012), there is a broader question about the organisation and performance outcomes of EPR as an older CE system to meet emerging societal challenges.

Previous research on EPR and tyre recycling in the EU has examined the various treatment options (Torretta et al., 2015) and progress across member states, including the steady departure from landfilling. Alternatively, Winternitz et al. (2019a) examined the EPR systems of three European countries, reflecting on their varying policy approaches, successes and potential limitations. Their findings demonstrated that an EPR system does not necessarily guarantee that waste tyres are disposed of in the most environmentally beneficial manner. Similarly, Lonca et al. (2018) examined the trade-offs of increased material circularity of tyres, contracted against other sustainability indicators, e.g. human and ecosystem health. Their research found that increased material circularity is beneficial from a resource perspective, but not necessarily from other environmental perspectives (Lonca et al., 2018). Such research adds to the complexity of organising disposal systems in a dynamic way that accounts for potentially conflicting issues within EOL processes.

Building on these examples, this chapter aims to critically examine the organisation and performance of an existing EPR system, to reflect on its strengths and suitability to deal with the broader needs within the contemporary CE debate. Based on this, we examine the question "how effectively do current ERP systems function from the current ambitions of CE?" We use EPR for tyres in the Netherlands as a case study to explore this question. This chapter, therefore, adds a practical understanding of the contribution of EPR to CE and provides insights for new and existing EPRs globally.

This chapter is structured as follows. First, a literature review of CE, EPR and tyre treatment practices is presented to further contextualize the analysis (Section 3.2[27]). Next, the research methods are presented (Section 3.3). This is followed by a description of the structure and outcomes of the EPR system for tyres in the Netherlands (Section 3.4). Our analysis (Section 3.5) builds on these results, showing the limitations and challenges for EPR systems to lead to a sustainable CE transition before concluding (Section 3.6).

3.2 Literature Review

3.2.1 Circular Economy: Origins, History and Implementation

While the CE concept itself dates back to 1990 (Pearce and Turner, 1990), the idea builds on a long history of literature on resource limits and ecological transformations such as

27 Readers guide: to avoid repetition on what is CE and EPR readers are advised to skip section 3.2.1 and 3.2.2.

the "Limits to Growth" (D. H. Meadows et al., 1972), the "Tragedy of the Commons" (Hardin, 1968), the "Economics of the Coming Spaceship Earth" (Boulding, 1966), "Small is Beautiful" (Schumacher, 1973) and "The Closing Circle" (Commoner, 1971).

More recently the CE has drawn its theoretical underpinnings from Industrial Ecology (IE) (Aryes, 1989; Saavedra et al., 2018), cradle-to-cradle (McDonough and Braungart, 2002) and performance economy (Stahel, 2010). The concept of CE is muddled and convoluted but is broadly based on the premise of retaining the functional use of products and materials within the economic sphere as long as possible. It is being advocated, in particular, by private sector consultancies, e.g. the Ellen MacArthur Foundation (UK) and Circle Economy (NL). Estimates suggest the cumulative outcome of earlier CE policies has resulted in the (re) cycling of as little as 6% of global materials, and 12% within the EU27, leading to a greater focus on increasing the value retention of material throughput (Haas et al., 2015).

The CE is also discussed as an evolutionary concept (cf. Blomsma and Brennan, 2017; Reike et al., 2018). Of particular importance for our analysis are the three phases of the CE concept proposed by Reike et al., (2018). First, CE 1.0 (1970 to 1990), is characterised by early waste management practices focused on waste output as an environmental pollution problem to be dealt with through EOL policies. This is when waste treatment and incineration plants started to be developed and operated, especially in the Global North.

The second phase CE 2.0 (1990 to 2010), saw the development of many "win-win" strategies, which make use of waste outputs as valuable resource inputs such as IE (Frosch and Gallopoulos, 1989), Cleaner Production (Fresner, 1998), Industrial Symbiosis (Chertow, 2000), Product-Service System (PSS) (Goedkoop et al., 1999), and EPR (Davis and Wilt, 1994). This is when the concept of CE was first coined by Pearce and Turner (1990) and when associated ideas appeared, such as "biomimicry" (Benyus, 1998), "cradle to cradle" (McDonough and Braungart, 2002), and "performance economy" (Stahel, 2010). This period also saw the widespread implementation of integrated waste management and recycling systems in the Global North, including EPR systems, which mandated new responsibilities for private sector actors (Reike et al., 2018b).

The third phase of CE 3.0 (from 2010), when discussions of the concept of CE became more widespread and began to be framed against encroaching societal threats, including planetary limits (Rockström et al., 2009), resource depletion, biodiversity loss, excessive waste generation etc. (Reike et al., 2018b). This has led to a more integrated and holistic understanding of material use, which aims to slow, reduce, narrow and close resource cycles in a systemic manner through changes in consumption and production structures and patterns (Reike et al., 2018b). However, this is also a period where varying visions of CE are conceived, which are either transformative or reformist depending on their position regarding the capacity for capitalism to overcome resource limits and decouple ecological degradation from economic growth (see Reike et. al., 2018; Friant et. al., 2019).

The implementation of CE-related activities and policies occurs in a variety of geographic contexts and scales. CE practices thus range from national programmes, e.g. China's 2009 CE 'Promotion Law' or international policies, e.g. the EU's 2015 CE 'Action Plan' (Ghisellini et al., 2016), to business models and individual company strategies (see Lüdeke-Freund et al., 2019). Scholars have sought to define CE activities through the potential value retention options that can be initiated throughout a product or material lifecycle, commonly described as the R-hierarchy. These range from 3Rs (Reduce, Reuse and Recycle) to iterations from four to ten. A recent review of 69 such R-imperatives outlined a synthesis of 10 comprehensive value retention options, which we adopt as our conceptual framing (Reike et al., 2018b) (Table 1.1). Whilst the narrative and framing around CE articulates its "newness", much of the EU policy approach follows or seeks to build upon older CE practices (EC, 2013; cf. Gregson et al., 2015; WFD 2018/851, 2018).

3.2.2 Extended Producer Responsibility

One such older CE practice is EPR, which is defined as "an environmental protection strategy to reach an environmental objective of a decreased total environmental impact from a product, by making the manufacturer of the product responsible for the entire life-cycle of the product and especially for the take-back, recycling and final disposal of the product" (Lindhqvist, 2000, p. 37). Crucially, the concept implies integrating responsibility in the whole product life cycle, where the physical and monetary waste managerial responsibilities (usually assigned to authorities and consumers) are transferred to the product producers.

EPR emerged in the 1990s, building on the experiences of waste managers, recyclers and a policy approach concerned with promoting cleaner production initiatives (Lindhqvist, 2000). Such developments illustrated the more proactive role private sector actors played in these earlier CE systems, giving them greater responsibility for the stewardship of their products. Such 'public-private' configurations represented new steering programmes practised by governments, as opposed to the conventional waste management policy of earlier years (CE 1.0) (Reike et al., 2018b; Vermeulen and Weterings, 1997).

EPR builds on the "polluter pays principle", incentivising producers to prevent waste generation, whilst (supposedly) encouraging eco-design and supporting the appropriate EoLprocesses, e.g. promoting recycling and reusing activities (Deutz, 2009; Ferrão et al., 2008). However, previous studies show EPR activities are overtly focused on EoL activities, negating an integrated lifecycle perspective that pursues continuous improvement and higher environmental performances through, for example, material choices and design for disassembly options (Vermeulen and Weterings, 1997). The EU has mandated the responsibility of producers for the EoL disposal of vehicles, batteries and accumulators, and waste electrical and electronic goods, whilst most member states have additionally implemented a producer responsibility organisation to process used tyres (Deutz, 2009; EC, 2014; ETRMA, 2015). Member states must ensure their EPR schemes have an appropriate collection and accessible schemes.

Alternatively, EPR has also been adopted in various countries in the Global South as a product management tool for EoL tyres (Banguera et al., 2018; Zarei et al., 2018). However, recent studies have illustrated the challenges of adopting EPR in these countries. Such challenges include the limited knowledge of effective practices in Botswana (Mmereki et al., 2019), incentivizing and integrating necessary actors in operations in Colombia (Park et al., 2018), and directly transposing a European policy tool to Brazil (Milanez and Bührs, 2009). Conversely, Cecchin et al.'s (2019) study in Ecuador highlighted the potential of integrating social economy goals with conventional EoL practices associated with EPR.

EoL processing in EPR systems can be organised in various ways. Spicer and Johnson (2004a) outline three approaches to implementation: (1) 'Original Equipment Manufacturer' takeback, where the original producer takes direct responsibility for collecting and processing; (2) 'Pooled Takeback', where responsibly is shared between a consortium of producers, known as the producer responsibly organisation (PRO), usually organised by a product category code, e.g. tyres; and (3) 'Product Responsibility Providers' (PRP), where a private third-party is contracted by the PRO and assumes EoL responsibly for the product on their behalf. This (theoretically) results in dual benefits for manufacturers and the general public, including, eliminating the financial risk associated with complex EoL processing activities (recycling, incineration, disassembly, remanufacturing, refurbishing etc.). Governments are responsible for rewarding and motivating good behaviour. Key regulatory aspects of an effective EPR system include formulating long-term objectives, fostering continuous improvements and updating targets, e.g. future scenarios, whilst encouraging frontrunners and compelling laggards (Vermeulen and Weterings, 1997). Public benefits include distributed local demanufacturing facilities and immediate economic feedback to product design, driving improvements (Spicer and Johnson, 2004). Challenges for local demanufacturers include knowledge of the original product blueprints, which producers can be unwilling to transfer, and finding suitable markets for recyclable materials. Earlier studies argued that this collective responsibility will weaken the eco-design drive of individual companies (Castell et al., 2008). Next, we document the characteristics and treatment options for tyres.

3.2.3 Composition and Treatment Options for Tyres

Rubbers are thermosetting materials, which makes material recovery challenging because of the vulcanization process during manufacturing (see Adhikari et al., 2000; Medina et al., 2018). Pneumatic tyres are a combination of synthetic and natural rubber, carbon black, elastomer compounds, steel chords, and textile fibres in addition to several other inorganic and organic compounds (Torretta et al., 2015). Natural and synthetic compounds act as sealants while fibre and steel chords give structure and carry tension (Feraldi et al., 2013).

There are several principal treatment practices for EoL tyres (see Table 3.1). First, product reuse (R2), which involves the direct sale of a tyre whose tread is still deep enough for safe use (the minimum tread depth is 1.6 mm in the EU). Second, retreading (R5), which involves replacing the outer tread of a tyre, when its general condition is insufficient. Repurposing (R6) is the reuse of a tyre for alternative uses, for which it was not originally designed, such as protection of racing tracks, materials for artwork, swings etc. Grinding (R7), involves the crushing and granulation of tyres to extract rubber and other components, such as steel and textile fibres (Aiello et al., 2009; Landi et al., 2018a, 2018b). Grinding produces rubber that is of relatively low quality, meaning only a small percentage (1-5%) can be used in new tyres. Devulcanization (R7) is a technological process where the rubber is chemically recycled to obtain higher quality rubber that can be used in higher percentage in new tyres (up to 30%) (Myhre et al., 2012). However, this technology is not yet commercially viable and has not been deployed on a large scale (Saiwari et al., 2019). Pyrolysis (R8) uses high temperatures (without oxygen) and chemical additives, for the recovery of energy, carbon black, activated carbon, oil and steel from EoL tyres; if well managed the process can have relatively low emissions (Myhre et al., 2012; Myhre and MacKillop, 2002; Sienkiewicz et al., 2012). Finally, incineration (R8) involves the burning of tyres with oxygen for the recovery of energy (often for cement kilns and other industrial furnaces); this process is less complex than pyrolysis but creates a significant amount of greenhouse gases and other air pollutants (Myhre and MacKillop, 2002).

3

TABLE 3.1 | R-hierarchy for tyre treatment.

R	Treatment Options
R0	Refuse via reducing vehicle ownership and using alternative modes of transport;
R1	Reduce via life extension
R2	Resell/Reuse discarded tyres which are safe and functional
R5	Remanufacture by retreading functionally sound discarded tyres
R6	Repurpose without or using less physical or chemical treatment
R7	Recycling via processes including devulcanization and grinding.
R8	Recovery of energy via pyrolysis or incineration

Whilst the notion of the 'R-hierarchy' might presuppose a prescriptive and preferable set of recovery operations, these only relate to the product or material attributes and do not account for contextual and broader systems factors, e.g. energy recovery; this might mean a lower R-strategy, could be preferable under some contexts and conditions. Deciding on the most effective treatment option can usually be ascertained through conducting a life cycle assessment (LCA). Various studies have explored this exact question in different national contexts (cf. Corti and Lombardi, 2004; Clauzade et al., 2010; Li et al., 2010; Fiksel et al., 2011; Feraldi et al., 2013; Ortíz-Rodríguez et al., 2017). There is a broad consensus that energy recovery as fuel can only capture up to 40% of the embedded energy within tyres (Amari et al., 1999). However, these assessments differ in terms of geography and scope, are non-standardised, hard to compare and, overall, they show conflicting and inconsistent outcomes. This points to the need for more standardised impartial regional (Social)LCAs, attributional and consequential, with local data, that can inform specific EPR systems as to the most preferable recovery and treatment option.

New CE business models of the 'performance economy' such as Product-Service Systems (PSS), that promote the leasing of products, services or performance instead of direct consumer ownership could facilitate high-value retention options (Camilleri, 2018; Kjaer et al., 2019; Stahel, 2010). Indeed, firms that maintain the ownership of their tyres are incentivised to design long-lasting (R1), reusable (R2), recyclable (R7) and retreadable (R6) tyres. However, this is not always the case, and strong regulation and careful management of possible rebound effects are needed to ensure that PSS lead to positive environmental outcomes (Demyttenaere et al., 2016; Hobson and Lynch, 2016; Junnila et al., 2018).

3.3 Materials and Methods

To evaluate the organisation and performance of an EPR scheme, this research adopted a case study research design, following procedural insights as outlined by Yin (2003). Case studies are defined as an in-depth description of a bounded system and are useful to examine phenomena in their contextual settings; they are particularly adept to understanding contemporary events (Yin, 2003, p. 5). Case studies are suited for qualitative methods, including those used in the study: interviews, literature review, policy and document analysis (Bryman, 2012).

This research uses the case study of EPR of tyres in the Netherlands, a system which has been in operation (to some degree) since 1995. This case selection was justified through two core reasons: (1) the Netherlands has, since 2005, had a high collection rate (≥ 100%) (ETRMA, 2015); and (2) the Netherlands has a substantially higher level of material reuse (e.g. direct reuse and recycling) than the European average, which is roughly 50% recycling and 50% energy recovery (Scott, 2015). This second point corresponds to the intention of moving up the waste hierarchy, the underlying principle for all EU recycling activity (EC, 2008). On this basis, the Netherlands represents a successful European EPR example and therefore the case for this research (cf. EC, 2014).

A limitation of a case study approach of a single EPR system is that it cannot lead to generalizable recommendations, even though the analysis provides useful practical insights for other cases. Nonetheless, the analysis of a single case can be used to generate preliminary observations and questions that can form the basis to evaluate future case studies or comparative research. Indeed, considering the specific history, geopolitical situation, socio-economic conditions and governance mechanisms in the Netherlands. The main lessons from this research cannot be generalized to other contexts, especially in the Global South, where conditions differ greatly. Moreover, all waste streams are unique due to their complex composition, legalities, processing techniques, hazardous nature etc. Therefore, the results and recommendations from this research are most relevant to our specific case study. Nevertheless, some of the lessons might apply to other socio-economic contexts and material streams, when supplemented by additional research on those other sectors and conditions.

Data collection was undertaken in two phases. First, we reviewed the available literature on CE, EPR and tyres (Section 3.2). This set our theoretical framing and perspectives for critically evaluating the EPR system (Section 3.4). The core data is comprised of policy and legal documents on EPR in the Netherlands from its inception in 1995 to 2017. This was supplemented with the EPR performance data, which (from 2005) has been reported annually to the government. Fieldwork was conducted between January to May 2019 which included nine in-depth unstructured interviews, lasting between 30 and 90 minutes, with government officials, industry and EPR representatives for tyres in the Netherlands. Interviewees either worked for the PRO, were members (producers, importers, distributors or EoL processors of tyres) or government officials involved in monitoring the performance of the EPR system. Fieldwork also included two site visits to tyre manufacturing and recycling facilities based in the Netherlands. Interviews were used to explain and elaborate on insights gained from the literature and document analysis. A complete list of the interviewees, data and their sources are in the supplementary materials of Campbell-Johnston et al. (2020a).

Next, we analysed the data. First, we reviewed the policy documents and performance data and, in conjunction with interviews, constructed an overview of the EPR system in the Netherlands (Section 3.4); this included history, an overview of the policy structure, actors, targets and key roles. Furthermore, we coded the performance of the EPR data using the 10R framework of Reike et al. (2018) to categorise the treatment outcomes. Second, we undertook a critical evaluation and reflection, using insights from the interviews and the literature to reflect on the strengths, weaknesses and issues about organisation and performance; including aspects of continuous improvement, policy scope and value retention outcomes (see Section 3.5).

3.4 Case Study Description

3.4.1 Regulatory and Legal Overview

The introduction of EPR in the Netherlands originates in the 1988 'Note on Prevention and Recycling of Waste', in which context the government introduced the concept of EPR in 1990 to enable a series of participatory policy projects designing the recycling strategies for 29 waste streams (Vermeulen et al., 1997; Vermeulen and Weterings, 1997).

Consequently, for the tyres waste stream the Dutch government introduced the Besluit Beheer Personenwagenbanden (Management of Passenger Car Tyre Decree) in 1995. Broad responsibilities were attributed to producers and importers to organise the collection and treatment of EoL tyres. In this EPR system, garages and tyre service companies collected old car tyres (mostly after replacing them with new ones) and charged the customer a fee for this collection and purchase of new ones. Garages and tyre service companies then passed the used car tyres to collection and processing companies along with the collection fee, to sort and adequately process used car tyres. A provisional collection target in the Decree was set at 60% product reuse (direct reuse is defined here as any recovery activity from R2 to R8, see Table 4.1), which included a minimum of 20% material reuse (R2 to R7) and maximum of 20% energy recovery (R8).

However, this system was open to exploitation, primarily through collectors taking the consumer fee and not passing the tyres onto processors. The consequential stockpiling resulted in municipalities and provinces financing the collection and treatment of illegally dumped EoL tyres (RecyBEM B.V., 2017, see supplementary material of Campbell-Johnston et al., (2020a)).

After many discussions between sectoral representatives and the Ministry of Housing, Spatial Planning and the Environment in 2000, the 2003 Besluit Beheer Autobanden (Car Tyre Management Decree) was developed. Producers were responsible for organising EoL collection and treatment, either individually or collectively. Key provisions of this act included (i) a focus on car tyres, caravans and trailers; (ii) a broad definition of 'producer', to include all producers, distributors and importers, who are responsible for organising the collection and treatment; and (iii) an old-for-new or 1-for-1 regulation, where the final user of the tyre, must be allowed to return the old tyres at no cost when purchasing a new one. All producers are required to pay a disposal fee, for every product brought onto the Dutch market. The treatment targets were not adjusted from the 1995 Decree, setting material reuse (R2 to R8) at 20% of the total weight of collected materials[28]. Moreover, producers and importers were required to report their performance to the government each year. This report must include (a) the number of car tyres that were made available to a party for the first time in that calendar year; (b) the number of used tyres collected in that calendar year; and (c) the percentage of used tyres processed.

Besides the 2003 Decree, the treatment for tyres has been regulated by EC Directive 1999/31/EC, which prohibits rubber tyres from going to landfill, and the Dutch Landelijk Afvalbeheerplans (LAPs) (National Waste Management plans) of 2003 (LAP 1), 2009 (LAP 2) and 2017 (LAP 3).

The first National Waste Plan of 2003 establishes the goal for 50% of the total weight of used rubber tyres to be reused as material (R2 to R8). However, the 20% goal of the Car Tyre Management Decree of 2003, has precedence over any objective of the LAPs. LAP 2 continued with the same objectives as the previous one but in its 2014 modification, it adds a "minimum standard" of at least "material recycling" (R7) for all tyres that can be recycled for less than €175 per tonne. For tyres that are not suitable for recycling or that cannot be recycled for less than €175 per tonne, energy recovery is considered the "minimum standard", and is thus allowed. In 2017, LAP 3 further increases the "minimum standard" for energy recovery to tyres that cannot be recycled for less than €205 per tonne.

28 Material reuse in the Decree is defined as: reuse of materials for the same purpose for which they were designed or for other purposes (R2, R5, R6, and R7), including energy recovery (R8).

The “minimum standard” is based on the ‘Ladder van Lansink’ (a motion accepted in the Dutch Parliament in the 1980s), which recommends reuse, recycling, energy recovery and landfilling as the appropriate sequence of treatment options (Lansink and Veld, 2010). A 2014 modification to LAP2 further expanded the collection responsibilities from passenger cars and light commercial vehicles to also include motor tyres, trucks, buses, agricultural vehicle tyres etc. Tyres from bicycles and scooters are excluded.

In 2018, the EU outlined a CE package, which amended the framework directive on waste (Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste). The renewed waste directive creates new requirements for EPR systems, including having effective data collection processes, transparent operations (including the selection procedure for waste management operators), and dialogue and collaboration with civil society organisations including social economy actors. The Directive also encourages (meaning it is not mandatory) member states to establish eco-design requirements that ensure products are easily recyclable, reusable, repairable and technically durable, contain recycled materials, and have reduced environmental impacts throughout their entire lifecycle.

These requirements were set to ensure that EPR contributes to a CE transition and operates according to the EU waste hierarchy, as established in article 4 of Directive 2008/98/EC. However, these new requirements have not been transposed into Dutch law yet as the Member States have until the 5th of July 2020 to do so, whilst EPR systems have until the 5th of January 2023 to update their structure and operations. Whether this results in substantial changes in the Dutch EPR scheme remains to be seen. However, it provides an opportunity to revisit the governance and circularity of the EPR system for tyres.

3.4.2 Extender Producer Responsibility: Structure and Implementation

In response to the 1995 Decree tyre importers, distributors and producers founded the ‘Vereniging Band en Milieu’ (Association BEM), to implement their obligation under this Decree. This body is formerly responsible for communications with the government. To manage the updated system established by the Car Tyre Management Decree of 2003, the tyre producers and importers founded two other organizations. First, the Stichting Fonds Band en Milieu (Foundation Funds for Tyre and Environment, hereafter known as the Foundation) is responsible for the financial management of the waste management system, and the collection and management of recycling fees. The Foundation functions to keep individual members’ financial contributions and market share confidential (Winternitz et al., 2019). The Foundation then established RecyBEM B.V., a private company, which is the collective implementation organization of the Association BEM. RecyBEM B.V. is thus contracted by the Foundation to manage the collection, processing and reporting of the EPR system (see Figure 3.1). In 2013, RecyBEM B.V. began setting voluntary processing targets, starting with 70% material and product reuse (R2, R5, R6 and R7) in 2013 to 90% in

2015. The system is thus structured as a third-party takeback where RecyBEM B.V. is the PRP (see Section 3.2.2).

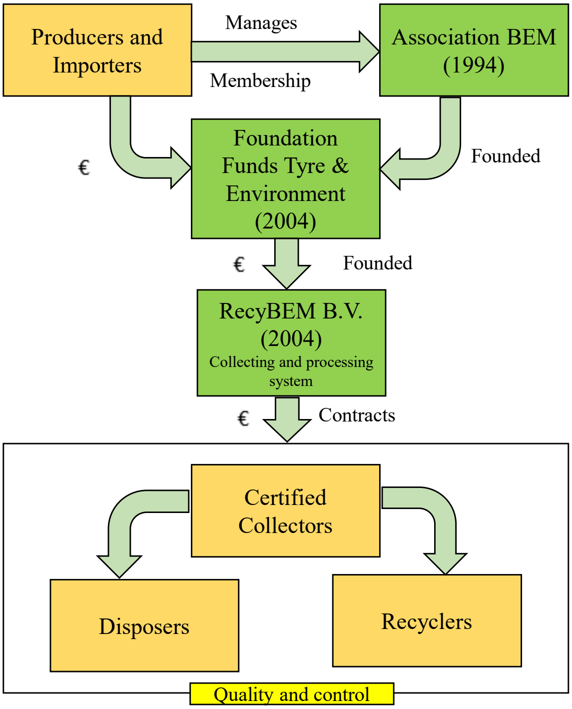


FIGURE 3.1 | Organization of the Dutch EPR (Source: RecyBEM B.V., 2019, edited).

To finance the system, all producers and importers of car tyres, caravans and trailers, must pay a waste management contribution fee to the Foundation for every tyre they put on the Dutch market. Between 2004 and 2015 only producers that were members of the Association contributed to the waste management fee. In response to protests from the Foundation over free riders not contributing fees, a 2015 government "general binding statement" (see supplementary material of Campbell-Johnston et al., (2020a)) allowed the PRP to oblige all producers, distributors and importers (both from retail and internet sales) to pay the waste management contribution fee to the Foundation or to establish another EPR system. Non-members can face legal action from the PRP for not contributing.

RecyBEM B.V. is the main operator of the waste management activities, the costs of which are covered by a contribution fee paid to it by the Foundation (see Figure 3.2). It uses the fee to contract and pay third-party collectors, which are in charge of bringing the tyres to processors, who recover the value from tyres based on the market conditions, RecyBEM B.V. criteria and state targets and regulations. To ensure the quality of the recycling operations, collectors can only operate with recyclers, disposers and processors that have been certificated by RecyBEM B.V., which includes a quality management system, as of

2018 following ISO 9001: 2015 standard (RecyBEM B.V., 2019, see supplementary material of Campbell-Johnston et al., (2020a)).

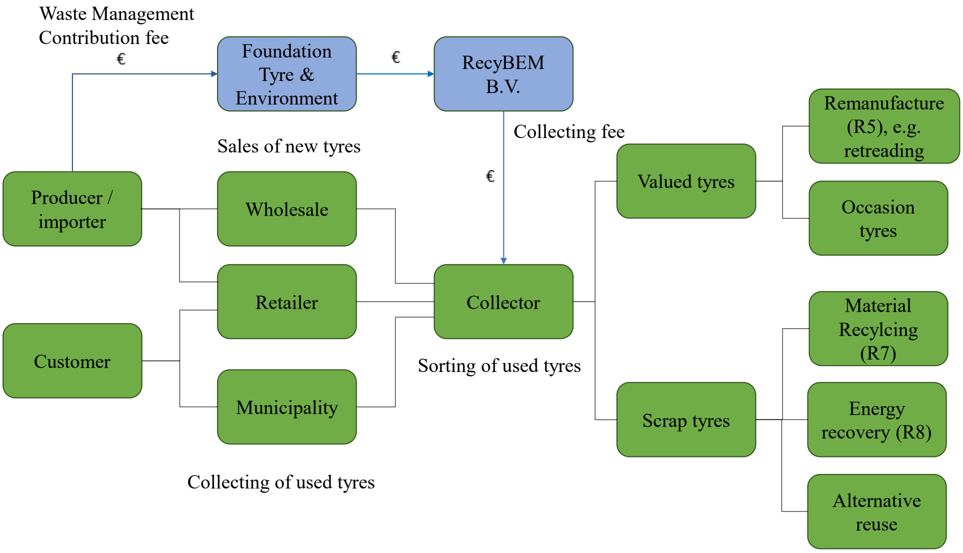


FIGURE 3.2 | Financial mechanism of the Car Tyre Management Decree, source: RecyBEM B.V., 2019, (edited).

In 2004, the waste management contribution fee, paid by importers and producers per tyre sold, was set at € 2,00 and by 2017 this had been reduced to € 1,30. This fee is internalised in the consumer price of a new tyre. Collectors (garages) are paid a part of this fee, which in 2004 was € 1,25 per collected tyre and in 2017 had been reduced to € 1,05 (see Figure 3.3). The difference between the collecting and the recovery fee is used by the PRP to cover administrative costs and unexpected expenses. Every year, the waste management contribution fee and the collecting fee are revised and updated based on a market study conducted by an independent third-party consultancy: Fact Management Consultants. The system operates with a pay-as-you-go structure where each year, a maximum waste management contribution fee is charged and, at the end of the year, a definitive waste management contribution fee is calculated based on the actual sale and recovery outcomes of the year and any surpluses and/or shortfalls are thus settled.

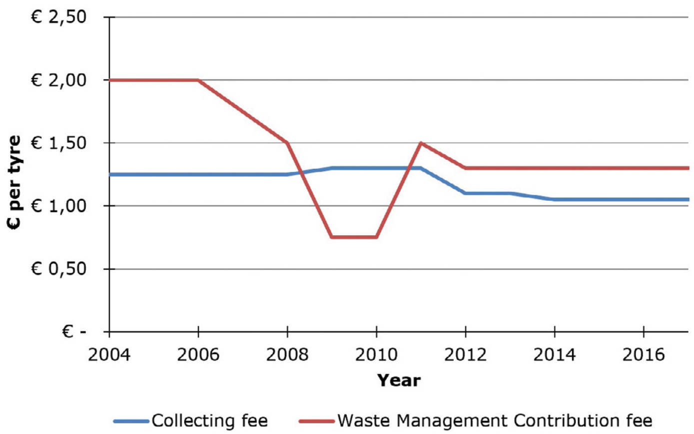


FIGURE 3.3 |Collecting and waste management contribution fee 2014-2017 (own work, source: annual reports see supplementary material of Campbell-Johnston et al., (2020a)).

3.4.3 Performance

The membership of the Association BEM has been rising continuously (Figure 3.4), representing over 90% of producers by 2015. The notable rise from 2015 is a consequence of the "general binding statement" of 2015, giving the PRO the power to compel non-compliant actors to pay into their system.

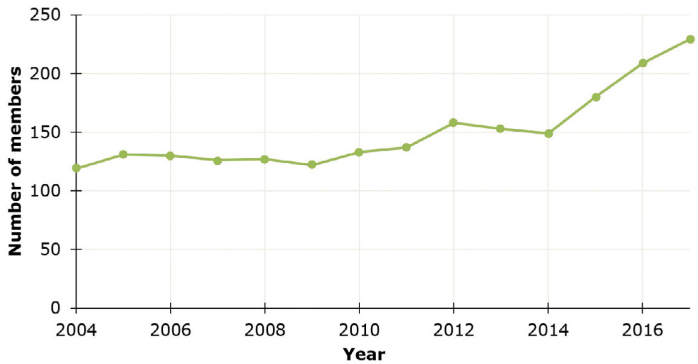


FIGURE 3.4 | Association BEM Members between 2004 and 2017 (own work, source: annual reports see supplementary material of Campbell-Johnston et al., (2020a)).

Figure 3.5 shows the high collection rates of the Dutch EPR system. The higher volume of sold tyres in 2010 and 2011 can be explained by the particularly cold winters of those years, and correspondingly higher sales of winter tyres. The higher collection rates of 2016 and 2017 can be explained by the implementation of the "general binding statement" of 2015, which led to new members joining the scheme.

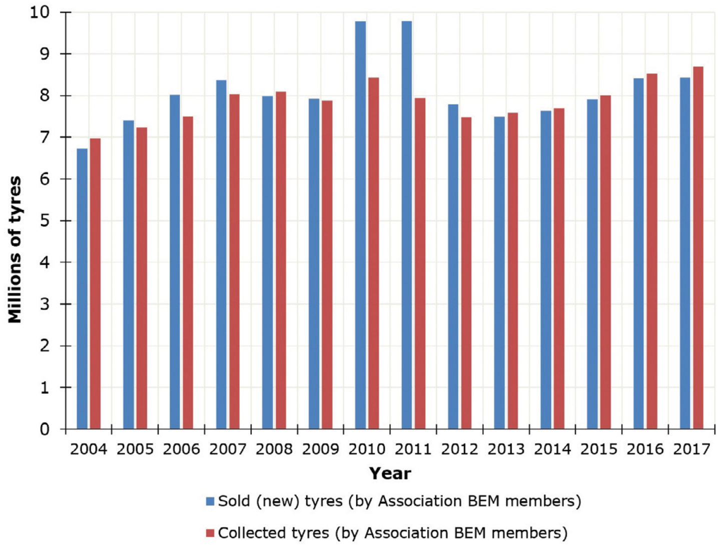


FIGURE 3.5 | Sold tyres vs. collected tyres between 2004 and 2017 2017 (own work, source: annual reports see supplementary material of Campbell-Johnston et al., (2020a)).

Figure 3.6 presents the destination of used rubber tyres managed by the PRP between 2005 and 2017. The red dotted line represents the 50% material and product reuse (i.e. R2, R5, R6 and R7) target established by the first National Waste Plan (2003). The red line indicates the 20% reuse as materials (i.e. R2, R5, R6, R7 and R8) target of the Car Tyre Management Decree of 2003. The dotted black line represents RecyBEM B.V.'s voluntary material and product reuse targets (i.e. R2, R5, R6 and R7): 70% by 2013, 80% by 2014 and 90% by 2015. The solid black line represents RecyBEM B.V.'s voluntary material reuse target (R7): 25% by 2013, 35% by 2014 and 50% by 2015.

Figure 3.6 and Table 3.2 show that the Dutch PRO has continuously met the targets in the National Waste Plan and the Car Tyre Management Decrees, as well as voluntary targets (see supplementary material of Campbell-Johnston et al., (2020a)). Moreover, the interviews from the public and private sectors confirmed that the minimum standard for incineration was also met, meaning no tyres that can be recycled for less than € 175 (2014-2016) or € 205 (2017 onwards) were sent for energy recovery. Therefore, no fines have been given to the organization for violating the rules.

The explicit nature of the recovery outcomes was further investigated and clarified during the interviews (see supplementary material interviewees of Campbell-Johnston et al., (2020a)). This allowed a better understanding of the implications and complexities of each recovery option. In the case of "product reuse" (R2), representing over 30% of EoL tyres in 2017, interviewees commented that many tyres are sold to countries in Eastern Europe, although the actual destinations are known only to the PRO[29]. Dutch consumers tend to change their tyres before the minimum recommended tread depth in the EU of 1.6 mm, due to the obliged annual car inspection (EC, 2019), so many discarded tyres still have a high use value. However, the future EoL and safe recovery of those tyres are no longer guaranteed once they are exported, if they go to destinations without the capacity to process them.

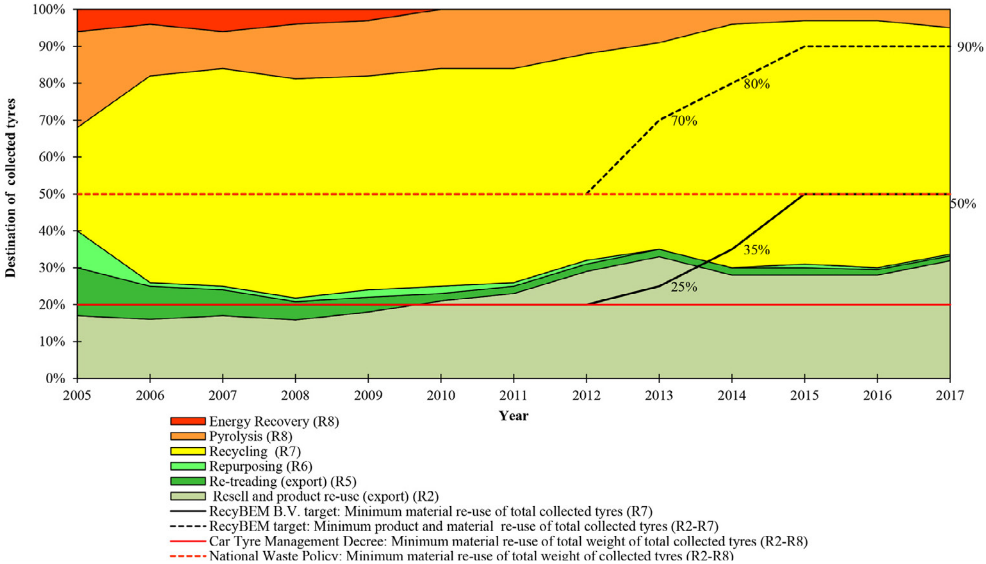


FIGURE 3.6 | Destination of collected used rubber tyres by RecyBEM B.V. between 2005 and 2017 (own work, source: annual reports see supplementary material of Campbell-Johnston et al., (2020a)).

TABLE 3.2 | Recycling targets and results for Dutch tyre recycling 2005 – 2017.

	RecyBEM B.V. target: Minimum material re-use of total collected tyres (R7)	RecyBEM target: Minimum product and material re-use of total collected tyres (R2-R7)	Car Tyre Management Decree: Minimum material re-use of the total weight of total collected tyres (R2-R8)	National Waste Policy: Minimum material re-use of the total weight of collected tyres (R2-R8)
Target	20% (2005-2012) 25% (2013) 35% (2014) 50% (2015-2017)	50% (2005-2012) 70% (2013) 80% (2014) 90% (2015-2017)	20% (2005-2017)	50% (2005-2017)
Result	2005-2012: 54% average 2013: 56% 2014: 66% 2015-2017: 64,8% average	2005-2012: 82% average 2013: 91% 2014: 96% 2015-2017: 96% average	2005-2017: 100% average	2005-2017: 100% average

29 We contacted the PRO for the data on the final destination of tyres on various occasions, but we were unable to obtain this information.

Regarding retreading operations (R5), very few tyres are suitable for retreading due to quality imperatives, hence very few EoL tyres can take this recovery route. Moreover, the Netherlands does not have any retreading plant, so tyres must be exported for this purpose and, once again, their EoL and safe recovery are not guaranteed in the importing country.

Repurposing (R6) represents a very small fraction of EoL tyres and concerns punctual and limited uses such as cart-track protections, and bumpers on quays and waterways.

Finally, recycling (R7), the most common recovery operation for EoL tyres, is carried out through granulation, which is used in a multiplicity of lower value outcomes, such as insulation materials, and engineering applications (mainly for road construction), filling for artificial sports fields etc. Due to energy efficiency, safety and quality imperatives, new tyres currently contain about one to five per cent of granulated rubber from EoL tyres.

Most interviewees reported a high level of satisfaction with the EPR system in the Netherlands. Tyre producers and distributors value the low cost of tyre recovery operations and the "hands-off" approach that this third-party take-back structure gives them. The PRO enjoys a great level of legitimacy due to its track record of compliance with government targets and low recovery costs. Producers and importers thus give a significant amount of autonomy to the organization (and PRP) and let it manage collection and recovery operations. Producers, importers, collectors and processors are not directly connected and don't collaborate, nor share information to improve tyre recycling outcomes or increase the uptake of recycled rubber in new tyres. There is little evidence that the Dutch EPR system provides an incentive for eco-design, rather it incentivizes producers and importers to outsource recovery operations at the lowest possible cost. While the PRO has financed several research and development projects on devulcanization, this is not enough to foster lifecycle thinking and a full closure of resource loops.

Despite this apparent success, there has been a recent backlash against recycled rubber and the EPR system in response to public concerns over the human and environmental health impacts of artificial sports fields made with recycled rubber granulate (Zembla, 2016). This led to a government inquiry on the topic and a series of reports were commissioned. In line with recent academic research (Bleyer and Keegan, 2018; Peterson et al., 2018), and evaluations of the European Chemicals Agency (ECHA, 2017), the Dutch government report on human health has found no evidence of cancer risks related to artificial turf fields made with recycled rubber (RIVM, 2017). However, other government reports evidenced important environmental impacts, especially for aquatic life (STOWA, 2018; Verschoor et al., 2018). This demonstrates the complexities of a circular system, which aims to narrow, slow, shrink, and close material cycles, and does so in ways that do not affect human and environmental health. This is often complicated, especially when dealing with complex recycling processes and materials containing a mixture of often unknown or toxic chemicals. This complexity poses the main obstacle to tyre management in the Netherlands.

3.5 Analysis and Future Implications

Since the initial experiments in 1995, the Dutch EPR system for passenger car tyres has reached a 100% collection rate, with low energy recovery levels (5% in 2017) and zero landfill. Interviewees viewed the system as stakeholder friendly, financially efficient, and effective at preventing the widespread illegal dumping of tyres, which occurred before the 2003 Decree. The system meets the minimum standards and targets set in the 2003 LAPs and the PROs voluntary targets. However, it also has many key obstacles, weaknesses and limitations both from the perspective of CE 2.0 and CE 3.0. This section outlines these challenges, and proposes recommendations, which, after careful adaptation, could also provide useful insights for new and existing EPRs in the global North and South alike:

Recommendations from a CE 2.0 perspective

Promoting higher-value recovery: Figure 4.6 and Table 3.2 demonstrate a high focus on recycling, yet the recycling of tyres currently produces low-quality granulate that cannot be used in large quantities in new tyres. This focus on material recovery is thus a form of downcycling, which does not allow for the closing of resource loops. Instead, greater priority should be given to other recovery options such as retreading, reuse and repurposing. Moreover, eco-design must be encouraged so that EoL tyres are easier to remanufacture and recycle and so that new tyres can contain higher quantities of granulated rubber without compromising on their quality. In this regard, further investment in R&D would be necessary and could be implemented by an obligation to use a percentage of the waste management contribution fee to finance it. An autonomous or government-established fund can be established to manage this part of the fee to finance transformative and disruptive innovations, which can challenge incumbents. Another option is to establish a differentiated fee based on the sustainability of tyres (durability, recyclability, percentage of recycled content etc.) to incentivise eco-design and innovation in the marketplace.

Managing exports and leakages: A large percentage of EoL tyres are exported for reuse and retreading (about 33% in 2017). While these are high-value recovery options, in theory, the lack of monitoring of the destination of these tyres does not guarantee an environmentally safe recovery. It is thus key to set up mechanisms to prevent exports from happening and to have greater oversight over the export destination and final disposal of tyres. This is a critical concern since tyres can have significant adverse human and environmental health impacts if they are not properly recycled (Li et al., 2010; Verschoor et al., 2018). However, controlling exports and following tyres through their multiple uses and owners is a complex process. A possible solution to this problem would be to raise consumer awareness and improve the annual car inspection process so tyres are not discarded before they reach the minimum tread depth. This would keep tyres in use for longer, improve their value for customers, and prevent them from being exported, thus reducing transport emissions and impacts overseas. The above measure would have to be combined with strong controls on the export of second-hand tyres so that tyres with a tread depth under the minimum standard are not exported for direct re-use. Moreover, enforcement of EoL tyre export controls should be reinforced so they are not exported to countries that do not meet Dutch social and environmental standards.

Recommendations from a CE 3.0 perspective

Aiming for sufficiency to reach the highest value retention options (R0, R1): Having longer-lasting tyres is perhaps one of the most important strategies, which can lead to significant sustainability improvements, as it directly reduces overall tyre consumption (R1 - reduce). The current EPR system has so far done nothing in this regard, and tyre consumption has increased between 2004 and 2017 (see Figure 3.5). The PRO could directly work with rubber tyre manufacturers and importers to design tyre in a way that guarantees their durability. This has the added benefit of reducing the number of resources spent dealing with EoL tyre management further down the product lifecycle. Awareness campaigns among consumers can also increase the lifespan of tyres and be done through a combination of product labels and media campaigns. This R1 strategy is second in the value retention hierarchy, leading to considerable environmental benefits, thanks to the reduced pressure on natural resources (rubber, iron, fibres etc.) and the avoided impacts from production, use and disposal of tyres.

An even more effective strategy would be to reduce tyre consumption by reducing the need for tyres in the first place (R0 – refuse). This could be achieved through effective urban and regional planning, as well as transport policies that encourage public transportation, rail, cycling and walking. However, these policies are beyond the concern of a PRO and can thus only be established by national, provincial and municipal governments. This shows the limitations of EPR systems in general, especially with the highest value retention options: R0 and R1. To implement these measures, a percentage of the waste management contribution fee can be given to a government agency or an autonomous institution responsible for reducing the overall domestic material consumption and ecological footprint through sufficiency strategies. This agency could thus develop innovative transportation solutions which work towards reducing the need for rubber tyres such as improved national rail networks, and sustainable urban planning solutions.

Collaboration and multi-stakeholder governance: The existing EPR system lacks effective connection and collaboration between tyre producers and recyclers. This inhibits product innovation concerning the application of reclaimed rubber. The EPR system for tyres in the Netherlands could hence be improved by further integrating recyclers, disposers and processors members with the BEM Association. This would reinforce collaboration across the whole value chain and ensure that the EPR system does not just incentivize low-cost recovery options.

Socially inclusive governance considerations have been disregarded by the Dutch EPR system. Various scholars have pointed out the importance of these aspects to construct a fair and fully sustainable CE (Hobson and Lynch, 2016; Kirchherr et al., 2017; Merli et al., 2018; Millar et al., 2019; Moreau et al., 2017), which tackles questions of intellectual property, technology transfer, ownership, production methods, benefit sharing and participation in decision-making processes. While the Dutch EPR does have a successful governance structure that includes all the relevant producers and importers (see Section 3.4.2), it is not particularly inclusive beyond direct industry members. This reduces the capacity for democratic oversight, transparency and accountability, leading to suboptimal outcomes in terms of recovery options and human and environmental health (see Section 3.4.3). To improve this, it is key to foster greater participation of civil society and public authorities in the governance, oversight and management of the EPR system. This can be achieved by forcing the BEM Association to include a certain percentage of civil society members, which represent the interests of citizens and the natural environment. This would force the EPR system to consider wider social and environmental concerns and improve the overall transparency and accountability of the system.

Effective monitoring and continuous improvement of the EPR system: Considering that collection targets have not been adjusted since 2003, and remain vaguely defined, it is key to update targets and explore the future direction of the sector. In fact, not only are the established recovery targets not ambitious enough but they were already met in the year they were set (see Section 3.4.3).

Setting renewed goals is particularly important as the current system promotes a standard and generally low waste management contribution fee, which has incentivised low-cost and low-quality recovery options over higher-value-retention ones. Moreover, the existing monitoring system reports only collected volumes and treatment processes. This leaves data gaps regarding how recovered materials are used and what is the final fate of exported EoL tyres, all of which can hide unsustainable practices.

The careful regulation and monitoring of the EPR system through effective government policy, civil society oversight, and continuously improving targets and incentives for higher-value retention options (especially R0-R6) is thus key. Moreover, it is necessary to overhaul the ways by which the best processing options are chosen (including the selection procedure for waste management operators) and the ways by which investments are carried out to achieve continuous improvements in new recovery options (e.g. R&D in devulcanization or pyrolysis). Better monitoring, transparency, oversight and civil society participation in these processes is key to ensure the continuous improvement of the EPR system and to promote socially and environmentally sustainable design and recovery practices.

mproving overall social and environmental outcomes beyond EoL tyres: The consequences of potentially socially and/or environmentally harmful uses of granulated rubber show the weakness of focusing on recovery alone rather than actual sustainability outcomes. It also raises the question regarding extended value chain governance, and whether producers should have continued responsibility beyond the first EoL processing of the product. Such expansions of capacities must be done only after impartial, non-conflicting, regional LCAs aimed at maximizing circularity, social fairness and sustainability. In fact, in such complex situations, having clear research and data at hand is vital to plan the best possible recovery options with human and ecological health in mind. Furthermore, a plan to improve the sustainability outcomes of the entire tyre supply chain should be established and implemented in coordination with a more democratic and inclusive EPR structure. This can ensure that the EPR system doesn't just recycle EoL tyres but also leads to tangible improvements in terms of socio-ecological outcomes, and raw material demand. The overall aim of a CE is not just to close resource loops, but to reduce the pressure of human activities on the planet to ensure the well-being of current and future generations (Kirchherr et al., 2017; Korhonen et al., 2018a). An EPR system should thus be understood as a component of a broader policy objective, which aims to sustainably and equitably reduce a country's overall environmental footprint.

Circular business models: Circular service or leasing business models based on the performance of tyres, rather than selling large quantities of tyres could be encouraged to incentivize higher-value maintenance for producers and consumers (Stahel, 2010). Indeed, under the right conditions, PSS can lead to a sustainable CE, since industries which keep ownership of their tyres have a direct incentive to develop long-lasting and easily recyclable products (Camilleri, 2018; Kjaer et al., 2019). It could thus improve reduce, reuse, retreading and quality recycling within the Netherlands, henceforth reducing the overall consumption and export of tires whose fate remains unknown once exported. However, this necessitates careful government oversight and regulation to prevent rebound effects and ensure that PSS lead to reduced overall resource use and create positive social and environmental sustainability outcomes (Hobson and Lynch, 2016).

The identified gaps and these proposed solutions provide an opportunity for the EPR organization to transform from being an EoL tyre management entity to a true driver of circularity, playing a transformative role in addressing prominent contemporary social and environmental challenges. In this transition, the system must be more inclusive, democratic and adaptive to continuous improvements. The existing fragmented systems of isolated EoL tyre management must be integrated into a value chain governance approach and high-value maintaining targets must be envisioned together and collectively worked towards with greater transparency.

The abovementioned recommendations are in line with those of the updated EU waste directive, which calls for EPR systems to include eco-design requirements to reduce environmental impacts as well as to improve transparency, reporting, monitoring and collaboration with civil society. There is thus now a unique opportunity to overhaul the Dutch EPR system through holistic CE 3.0 strategies, leading to both improved human well-being and ecosystem functioning.

However, a possible limitation of the above recommendations is the small size of the Netherlands in the global market for tyres. Indeed, the country imports most of its tyres and can hardly force large tyre producers overseas to significantly change their design and production processes. EU-wide directives with ambitious targets are necessary, especially on for tyre recycling, retreading, repurposing, and the percentage of recycled content in new tyres. Indeed, while the EU has established a new CE action plan with various new policies, it has not taken further action on tyres or rubber recycling. Further action from a holistic CE 3.0 perspective is hence needed both nationally and internationally. Another key limitation of the above recommendations is that they are directed towards the unique social, historical, political, economic and technical circumstances of the Dutch EPR system for EoL tyres. Therefore, further research is needed to validate and apply our insights and commendations to other case studies and waste streams.

3.6 Conclusion

This chapter examined and evaluated the structure, organisation, performance and potential limitations of the Dutch EPR system as a case study to explore how these older CE 2.0 systems can be adapted to fulfil the broader societal concerns embedded in the current CE 3.0 debates (i.e. concerns over resource supply, planetary limits, waste generation). It adds a practical understanding of the relationship between EPR and CE, and the former's capacity to contribute to the latter.

Despite this representing a successful example of CE 2.0 initiatives and fulfilling the obligations of the national legislation, our analysis outlined seven limitations and issues, which, we argue, can be the basis for modifying and creating an EPR that meets the needs of the existing CE 3.0 debate. Current EPR systems of CE 2.0 can achieve high recovery rates, but they do not reduce overall resource consumption and promote full circularity, in line with CE 3.0. Thus, this chapter suggests strengthening the EPR system by proposing a long-term transformative perspective, which can address issues concerning transparency, inclusion, sufficiency, sustainability and continuous improvement. These lessons could be applied to different contexts and waste streams with careful research and adaptation. Moreover, we examined the internal consideration of the Dutch EPR system. As Circularity in the Netherlands is inherently tied to a European and global circularity, any exports should be strictly controlled and regulated to ensure high-value retention and sustainability.

This research further illustrates the limits of recycling and traditional recovery operations. CE is often characterised as a tool for closing resource loops and turning wastes into resources. However, low-quality recovery options complicate this as a closed-loop for tyres cannot simply be established with current technologies. Whilst devulcanization could potentially improve recovery outcomes, it is not commercially operational on a large scale and only enables the use of up to 30% secondary rubber in new tyres; still far from a closed loop. This shows the limits of R3-10 and the importance of sufficiency strategies, especially R0-1 to reach a CE with tangible results in terms of reduced material demand and ecological footprint. The above points are beyond the scope of this chapter and demonstrate the complexity of the CE, and the need for specific case studies to improve its governance and implementation.

Moreover, the insights and recommendations learned from this chapter are limited to the recovery of tyres in the Netherlands, and further research is needed in other contexts to develop specific and culturally adapted recommendations. In particular, transdisciplinary research with key actors and stakeholders could be an effective manner to build solutions for a sustainable, circular, and participatory overhaul of EPR systems.

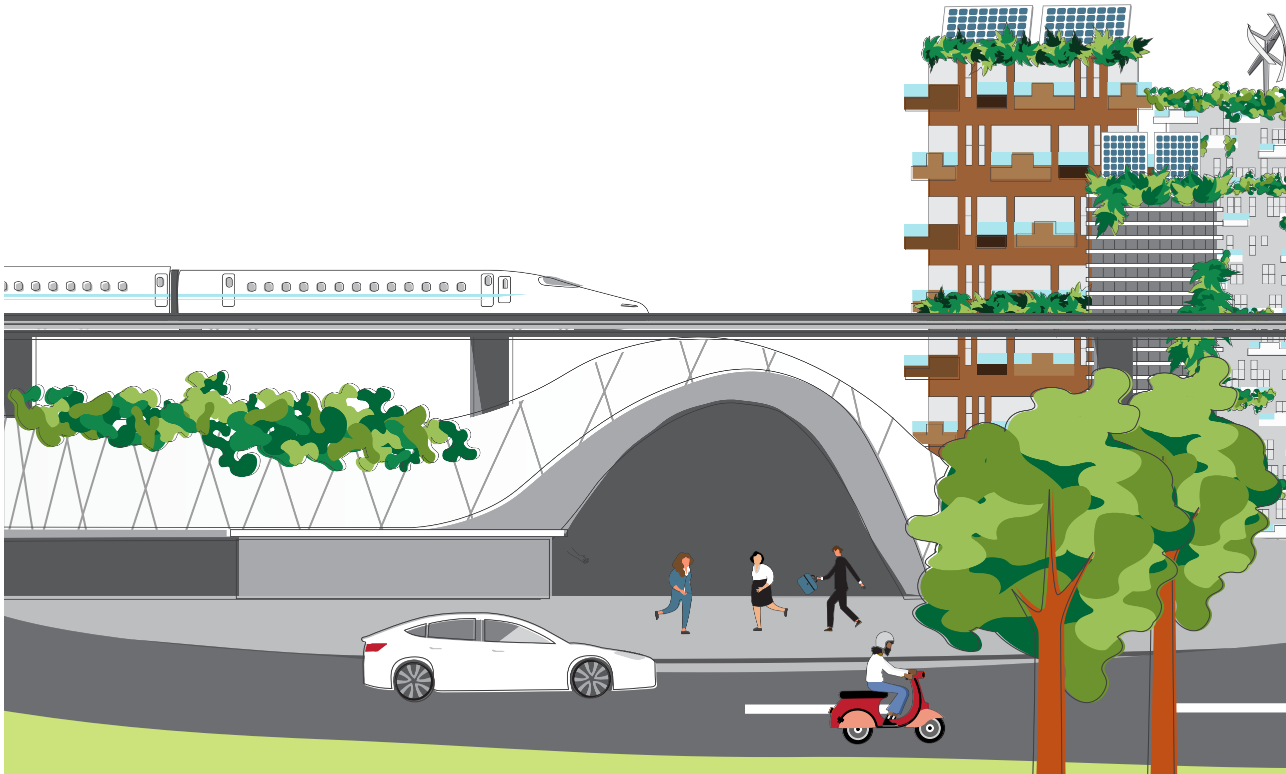
Future comparative analysis of EU EPR systems is also needed to uncover how they interfere with each other in the context of the single market. A broader study could also provide further insights into structural issues and challenges for EPR systems in general and uncover other possible best practices for EPR systems from a CE perspective.

Chapter 4

Analysing European Union Circular Economy Policies: Words Versus Actions

This chapter is based on Calisto Friant, M., Vermeulen, W. J. V., & Salomone, R. (2021). Analysing European Union circular economy policies: words versus actions. Sustainable Production and Consumption, 27, 337–353. https://doi.org/10.1016/j.spc.2020.11.001

Previous versions of this work were presented at the 25th International Sustainable Development Research Society (ISDRS) Conference in Nanjing, China on the 27th of June 2019 and at the PubliER conference in Troyes, France on the 30th of January 2020.



Abstract

Since the publication of the European Union's Circular Economy Action Plan in 2015, this new sustainability paradigm has become a guiding force behind the environmental and economic policies of the Junker Commission. The European Union (EU) has taken a particular approach to circularity, with high expectations to increase competitiveness, promote economic growth and create jobs while reducing environmental impacts and resource dependency. However, the circular economy (CE) is a contested paradigm, for which many competing interpretations exist, each seeking varying degrees of social, ecological and political transformation. Considering the emerging and contested state of the academic literature on CE, the EU's embrace of the concept is a remarkable phenomenon, which remains poorly researched. The aim of this chapter is thus to address this research gap by analysing the CE discourse and policies of the Junker Commission (2014-2019) in order to critically discuss their sustainability implications and develop key policy recommendations. To do so, this research uses a combination of qualitative and quantitative research methods. The chapter first critically analyses the EU's discourse based on a typology of circularity discourses. It then reviews the complex set of concrete CE policies and actions adopted by the EU and compares them to its discourse. Results show a dichotomy between words and actions, with a discourse that is rather holistic, while policies focus on "end of pipe" solutions and do not address the many socio-ecological implications of a circularity transition. Several actions are thus recommended to tackle the systemic challenges of a circular future from a plural perspective.

4.1 Introduction

From a little-known concept coined in the late 20th century, the circular economy (CE) is now recognized by the European Union (EU) as an "irreversible, global mega trend" (COM 2019/190, p10). The CE has indeed become an essential strategy in the ambition of the Junker Commission (2014-2019) to create a "sustainable, low-carbon, resource-efficient and competitive economy" (COM 2015/614, p6) and it is now a key component of the European Green Deal and the Coronavirus Recovery Plan of the Von der Leyen Commission (2019-present) (European Commission, 2020).

Embracing the idea that the CE will "modernise the EU industrial base to ensure its global competitive edge and preserve and restore the EU's natural capital" (COM 2019/190, p11), the EU seems to consider the CE as a "magic bullet" that can resolve the manifold economic and environmental challenges of the Anthropocene. However, the social, ecological and political implications of the CE are only starting to be understood by the scientific literature (Clube and Tennant, 2020; Geisendorf and Pietrulla, 2018; Ghisellini et al., 2016; Merli et al., 2018; Prieto-Sandoval et al., 2018). Evidence regarding the economic, social and environmental impacts of CE policies and practices is still lacking (Antikainen et al., 2018; Donati et al., 2020; Hobson and Lynch, 2016; Korhonen et al., 2018a; Velis, 2018). Core challenges remain little researched, such as the implication of the CE on the complex trade-offs and synergies between climate change, biodiversity and resource scarcity (Bleischwitz and Miedzinski, 2018; Giampietro, 2019; Lehmann et al., 2018; Schroeder et al., 2019). The implications of the CE for economic growth/degrowth, social justice and global sustainability also need to be further researched and understood, especially taking into account the impacts of entropy and the rebound effect (Mayumi and Giampietro, 2019; Millar et al., 2019; Moreau et al., 2017; Murray et al., 2017; Temesgen et al., 2019).

Considering the emerging state of the academic literature on the topic, the impressive growth and adoption of the concept by the EU is a remarkable phenomenon, which deserves further research. Indeed, the CE is still a contested concept, with many different societal actors seeking to influence its meaning and understanding with a diversity of conflicting approaches to circularity (Calisto Friant et al., 2020; Korhonen et al., 2018b; Lazarevic and Valve, 2017; Repo et al., 2018). By choosing one of many contrasting CE visions, and implementing it on a large scale, the Commission will determine the future and meaning of circularity in Europe and beyond. There are thus important conceptual implications with the EU's choice of circularity discourses and policies.

In this context, several academics have stressed the need to further investigate the EU's interpretation and implementation of the CE concept (Colombo et al., 2019; Fitch-Roy et al., 2020; Foschi and Bonoli, 2019; Krämer, 2019; Pollex and Lenschow, 2018; Rijnhout et al., 2018). While various articles have looked at specific aspects of the EU's CE policies (Baran, 2020; Colombo et al., 2019; Elliott et al., 2020; Farmer, 2020; Fitch-Roy et al., 2020; Foschi and Bonoli, 2019; K. Hartley et al., 2020; Kirchherr et al., 2018; Knill et al., 2020; Krämer, 2019; Lazarevic and Valve, 2017; McDowall et al., 2017; Milios, 2018; Moraga et al., 2019; Pollex and Lenschow, 2018; Repo et al., 2018; Steenmans, 2019; Talens Peiró et al., 2020; Völker et al., 2020; Wieliczko, 2019) no research so far has comprehensively analysed the discourse and sustainability implications of the CE package of the Junker Commission[30]. This chapter tackles this research gap by analysing the EU's discourse and policies on the CE through the discourse typology developed by Calisto Friant, Vermeulen and Salomone (2020), which classifies and conceptually differentiates circularity visions based on their position on fundamental social, political and ecological aspects. The aim of this research is thus to apply the abovementioned discourse typology to the Junker Commission's CE policy to uncover the EU's core vision regarding the transition towards a CE and critically assess its key sustainability implications with respect to other possible circular futures. The research question is hence: What discourse of the CE is advanced by the policies of the Junker Commission (2014-2019), what sustainability implications does it have and what alternative policies from the perspective of other circularity visions could be recommended?

To answer this research question, this chapter first presents its conceptual framework on the CE (§ 4.2) and explains its research methods (§ 4.3). It then assesses the EU's discourse on the CE, through quantitative content analysis (§ 4.1). Section 4.4.2 reviews the EU policies on the CE, including their core targets and regulations and section 4.4.3 critically analyses their content based on the discourse typology developed by Calisto Friant, Vermeulen, and Salomone (2020). Finally, the discussion reflects on these results and develops recommendations from the perspective of other circularity visions. This research unfolds the Commission's vision of the CE and points out inconsistencies between the EU's discourse and the targets and policies which are implemented by its directives and regulations. Alternative policy directions are thus recommended through interventions that tackle the systemic social, ecological and political implications of a circular future in an integrated manner.

4.2 Conceptual framework

To analyse the EU's perspective, this research uses the typology of circularity discourses developed by Calisto Friant, Vermeulen and Salomone (2020). This typology is based on extensive research of the CE and CE-related concepts through history, leading to a comprehensive framework of analysis to better evaluate, untangle and navigate the many visions of this contested paradigm. This framework is thus very well suited to understand what circular future the EU is proposing, and what implications this has in relation to other circular futures.

30 A Scopus search for "European Union" "circular economy" "policy analysis" OR "discourse analysis" (title, abstract, keyword) leads to 4 results, none of which examine the CE package of the Junker Commission (search conducted on the 10/06/2020).

Table 4.1 resumes this 2x2 discourse typology, which, differentiates between *holistic* and *segmented* discourses and between *optimist* or *sceptical* discourses (see Figure 4.1).

Segmented discourses have a homogeneous perspective that focuses only on the technical, industrial and business components of circularity in order to improve resource efficiency. *Holistic* discourses integrate the many social and political implications of circularity and thereby also seek socio-political and cultural change. *Sceptical* discourses don't believe that socio-technical innovations could prevent an ecological collapse by decoupling economic growth from environmental exploitation (eco-economic decoupling)[31]. *Optimist* discourses, on the other hand, believe that socio-technical innovations can lead to eco-economic decoupling and thereby prevent an ecological collapse (Calisto Friant et al., 2020).

Different combination of the two differentiations above leads to four core discourses on circularity, which are presented in table 4.1. These four discourses are: *reformist circular society* (*optimist* and *holistic*) seeking a prosperous, fair, democratic and sustainable future for all through a combination of technological breakthroughs, social innovations, and alternative business models. *Technocentric circular economy* (*optimist* and *segmented*) aiming to reconcile economic and environmental imperatives through technological innovations, especially in biotechnology, renewable energy and resource recovery. *Transformational circular society* (*sceptical* and *holistic*) seeking to completely reconfigure the current societal system and democratize and redistribute wealth and power so that humanity and nature might live in mutual harmony. *Fortress circular economy* (*sceptical* and *segmented*) aiming to secure natural resources, economic prosperity, socio-ecological resilience and geopolitical power through top-down migration controls, technological innovations and economic nationalism.

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

TABLE 4.1 | Main components of circularity discourse typology.

	4 Circularity Discourse Types	
Discourse component	**Reformist Circular Society** (optimist and holistic)	**Technocentric Circular Economy** (optimist and segmented)
Perspective on technological innovation and ecological collapse	**Optimist:** Technical innovations can enable eco-economic decoupling to prevent ecological collapse.	**Optimist:** Technological innovations can enable eco-economic decoupling to prevent ecological collapse.
Approach to socio-political components of circularity	**Holistic:** includes social and political implications of circularity.	**Segmented:** focuses on technical, industrial and business components of circularity.
Goals	Prosperity and wellbeing for all within the biophysical boundaries of the earth.	Human progress and prosperity without negative environmental externalities.
Means	Technological breakthroughs and social innovations that benefit humanity and natural ecosystems.	Economic innovations, new business models and unprecedented breakthroughs in CE technologies
Value-retention focus	R2-7	R4-9
Example concepts	- Natural Capitalism (Hawken et al., 1999) - Cradle to Cradle (McDonough and Braungart, 2002) - Performance Economy (Stahel, 2010) - Blue economy (Pauli, 2010).	- Industrial Metabolism (Ayres and Simonis, 1994) - Reverse Logistics (Rogers and Tibben-Lembke, 1998) - Biomimicry (Benyus, 1998) - Industrial Symbiosis (Chertow, 2000).
Example proponents	- Civil society discourses such as Circle Economy, (Verstraeten-Jochemsen et al., 2018) and the Club of Rome (von Weizsäcker and Wijkman, 2017).	- National and city government policies, corporate strategies and international organizations (Fratini et al., 2019; Valenzuela and Böhm, 2017).

Source: based on Calisto Friant, Vermeulen and Salomone 2020

4

4 Circularity Discourse Types	
Transformational Circular Society (sceptical and holistic)	**Fortress C ircular Economy** (sceptical and segmented)
Sceptical: Technical innovations cannot bring absolute eco-economic decoupling to prevent ecological collapse.	**Sceptical:** Technical innovation cannot bring absolute eco-economic decoupling to prevent ecological collapse.
Holistic: includes social and political implications of circularity.	**Segmented:** focuses on technical, industrial and business components of circularity.
A world of conviviality and frugal abundance for all, while fairly distributing the biophysical resources of the earth.	Maintain geostrategic resource security in global conditions where widespread resource scarcity and human overpopulation cannot provide for all.
Complete reconfiguration of the current socio-political system and a shift away from productivist and anthropocentric worldviews.	Innovative technologies and business models combined with rationalized resource use and migration and population controls.
R0-6	R0-9
- Conviviality (Illich, 1973) - Steady-state economics (Daly, 1977) - PermacircularEconomy (Bourg, 2018) - Degrowth (Latouche, 2009) - Radical Pluralism (Kothari et al., 2019).	- The tragedy of the Commons (Hardin, 1968) - The Population Bomb (Ehrlich, 1968) - Overshoot (Catton, 1980).
- Social movements, bottom-up circular initiatives, and indigenous movements (Hobson, 2019; Kothari et al., 2019; Marin and De Meulder, 2018).	- Think tanks and geostrategic state policies (Cavanagh and Benjaminsen 2018; Fletcher 2012; Hendrixson and Hartmann 2019; Mehta, Huff, and Allouche 2019).

4

4.3 Methods

To analyse the EU's discourse and situate it in the classification described in table 4.1, this research follows a mix of qualitative and quantitative methods. The quantitative analysis adapts the methods of corpus-based research (Subtirelu and Baker, 2017) and content analysis (Kondracki et al., 2002; Wiese et al., 2012), which were previously used in similar contexts to examine the EU's policies of eco-innovation (Colombo et al., 2019), to study civil society's sustainability transition discourses (Feola and Jaworska, 2019), to comparatively analyse circular, bio and green economy discourses (D'Amato et al., 2017), and to contrast EU and citizen perspectives on the CE (Repo et al., 2018).

The method used in this chapter consists of counting the frequency of a specific set of predetermined keywords within a group of texts (corpus)[32]. It has been recognized as an effective tool to systematically and objectively distinguish the core discourses, concepts, and ideas in large groups of documents (Kondracki et al., 2002; Wiese et al., 2012). However, the choice of keywords is subjective, and it is thus key to select them based on a solid theoretical foundation. Therefore, the circularity discourse typology presented in section 4.2 was chosen as the basis for keyword selection to guarantee a strong conceptual validity.

Keywords were grouped in thematic areas corresponding to the different conceptual components of the four circularity discourse types (see Figure 4.1). The comparative frequency of their use thus demonstrates the extent to which the EU's official policies focus on those topics and the circularity discourse typology that they reflect.

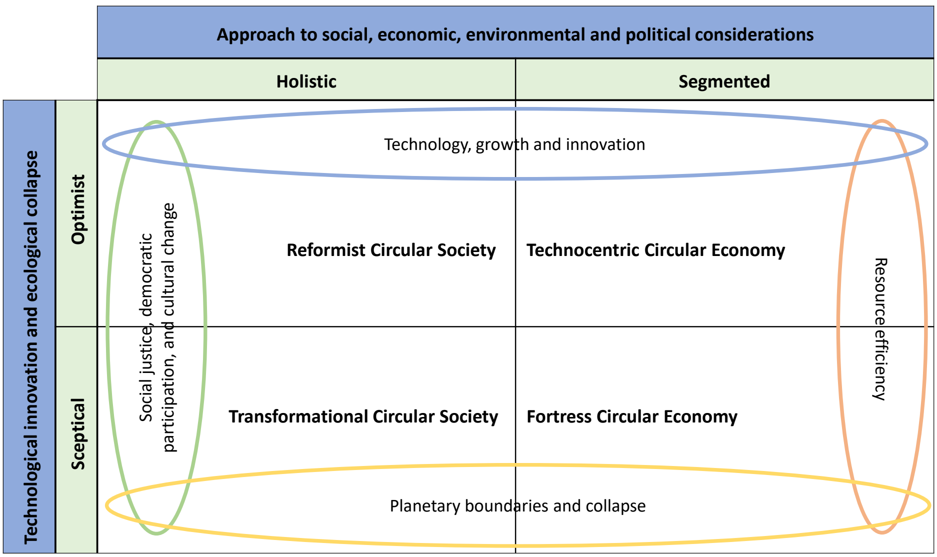


FIGURE 4.1 | Circularity discourse types and their main keyword groups.

32 All queries and keyword mining were conducted with the program NVivo 12 Pro.

The analysis is carried out in a corpus based on the 10 communications, 8 regulations and the 7 Directives on the CE[33], which have been enacted by the EU's Junker Commission since the Publication of the CE Action Plan in December 2015 and up to December 2019 when the Von der Leyen commission took office. The studied corpus thus contains a total of 25 legislative documents with 300.046 words (see table 4.2). EU reports and staff working documents were not mined for keywords as they are not legislative documents and don't dictate official EU positions on circularity; they might thus bring a bias to the corpus with ideas and statements, which do not reflect the official EU stance on circularity. Moreover, in policy reports, keywords might be used to criticize a concept rather than promote it. A report criticising *economic growth*, *eco-innovation,* or *biotechnology*, for example, might use those concepts without endorsing them. A careful revision of our query results shows that this was not the case in the selected policy documents, as their focus is to communicate and legislate on a specific area, not to critically analyse concepts or assess different policy options.

TABLE 4.2 | EU Communications, Directives and Regulations on the CE.

10 communications	1. COM(2015) 614 Closing the loop - An EU action plan for the Circular Economy 2. COM(2016) 773 Ecodesign Working Plan 2016-2019 3. COM(2017) 479 Investing in a smart, innovative and sustainable Industry A renewed EU Industrial Policy Strategy 4. COM(2017) 33 final Report on the implementation of the Circular Economy Action Plan 5. COM(2018) 28 A European Strategy for Plastics in a Circular Economy 6. COM(2018) 29 On a monitoring framework for the circular economy 7. COM (2018) 32 Communication on the implementation of the circular economy package: options to address the interface between chemical, product and waste legislation 8. COM (2018) 35 Report on the impact of the use of oxo-degradable plastic, including oxo-degradable plastic carrier bags, on the environment 9. COM(2019) 22 Reflection Paper Towards a Sustainable Europe by 2030 10. COM(2019) 190 final Report on the implementation of the Circular Economy Action Plan
7 Directives	1. Directive (EU) 2018/849 amending Directives 2000/53/EC on end-of-life vehicles, 2006/66/EC on batteries and accumulators and waste batteries and accumulators, and 2012/19/EU on waste electrical and electronic equipment 2. Directive (EU) 2018/850 amending Directive 1999/31/EC on the landfill of waste 3. Directive (EU) 2018/851 amending Directive 2008/98/EC on waste 4. Directive (EU) 2018/852 amending Directive 94/62/EC on packaging and packaging waste 5. Directive (EU) 2019/883 of 17 April 2019 on port reception facilities for the delivery of waste from ships, amending Directive 2010/65/EU and repealing Directive 2000/59/EC 6. Directive (EU) 2019/904 of 5 June 2019 on the reduction of the impact of certain plastic products on the environment 7. Directive (EU) 2019/771 of 20 May 2019 on certain aspects concerning contracts for the sale of goods, amending Regulation (EU) 2017/2394 and Directive 2009/22/EC, and repealing Directive 1999/44/EC

33 Directives set binding obligations on member states, such as targets, data collection processes, and policy requirements but must be transposed into the national law of each member state in order to be implemented. Regulations are directly applicable without the need for transposition into member state law, they establish requirements on areas for which the EU has direct and often exclusive competencies, such as eco-design and product-labeling requirements. Communications have no direct legal effect, rather they establish policy directions and strategies for a topical issue, which may lead to future EU regulations or directives (Farmer, 2020).

8 Regulations	1. Regulation (EU) 2019/1009 of 5 June 2019 laying down rules on the making available on the market of EU fertilising products and amending Regulations (EC) No 1069/2009 and (EC) No 1107/2009 and repealing Regulation (EC) No 2003/2003 2. Regulation (EU) 2019/424 of 15 March 2019 laying down ecodesign requirements for servers and data storage products pursuant to Directive 2009/125/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 617/2013 3. Regulation (EU) 2019/1784 of 1 October 2019 laying down ecodesign requirements for welding equipment pursuant to Directive 2009/125/EC of the European Parliament and of the Council 4. Regulation (EU) 2019/2021 laying down ecodesign requirements for electronic displays pursuant to Directive 2009/125/EC, amending Regulation (EC) No 1275/2008 and repealing Regulation (EC) 642/2009 5. Regulation (EU) 2019/2023 laying down ecodesign requirements for household washing machines and household washer-dryers pursuant to Directive 2009/125/EC, amending Regulation (EC) No 1275/2008 and repealing Regulation (EU) No 1015/2010 6. Regulation (EU) 2019/2019 laying down ecodesign requirements for refrigerating appliances pursuant to Directive 2009/125/EC and repealing Regulation (EC) No 643/2009 7. Regulation (EU) 2019/2024 laying down ecodesign requirements for refrigerating appliances with a direct sales function pursuant to Directive 2009/125/EC 8. Regulation (EU) 2019/2022 laying down ecodesign requirements for household dishwashers pursuant to Directive 2009/125/EC amending Regulation (EC) No 1275/2008 and repealing Regulation (EU) No 1016/2010

The selection of keywords for the analysis was based on a detailed examination of the four discourse types, as described by the typology, as well as a revision of their related concepts and literature (see table 4.1). A first set of 262 keywords was thus established, which sought to include as many relevant terms as possible. Keywords were then grouped in different thematic areas and the selection was refined by removing or changing words that had various meanings or that could be used in contexts that are not relevant to the object of this research (such as refuse, reduce, share, limits etc.)[34].

A further refinement of this selection of keywords was then carried out to ensure that each opposing discourse type (*holistic* versus *segmented* and *optimist* versus *sceptical*) had the same number of keywords and could thus be better contrasted and compared. A final set of 136 keywords was hence used in this analysis (see supplementary materials of Calisto Friant et *al.* (2021) for the full list of keywords).

S*ceptical* and *optimist* discourses were distinguished by two groups of keywords, the first representing technology, economic growth and innovation, which are the core focus of *optimist* imaginaries. The second represents planetary boundaries and collapse, which are the core components of *sceptical* discourses (see table I in the supplementary materials of Calisto Friant et al. (2021)).

Similarly, *holistic* and s*egmented* discourses were divided into two groups of keywords, the first related to social justice, democratic participation, and cultural change, which represent

34 For instance, the keyword "just" might refer to "fairness", "only" or "exactly". The choice of keywords was therefore carried out with great care and query results were systematically revised to ensure they are relevant to the object of this research.

the main components of *holistic* visions. The second relates to resource efficiency which is the core focus of *segmented* discourses (see table II in the supplementary materials of Calisto Friant et al. (2021)).

After this quantitative keyword analysis, a qualitative analysis of EU targets and policies on the CE is carried out based on an in-depth review of the concrete measures established in the EU directives and regulations of the examined corpus (see table 4.2). This qualitative work first resumes the complex set of new directives, regulations and policies established by the Junker Commission (§ 4.4.2) in order to analyse them based on the typology of circularity visions presented in section 4.2. This allows for a critical analysis of the Commission's CE policies as well as an evaluation of their congruence with respect to the EU's discourse on the CE (§ 4.4.3). The discussion reflects on the implications of the results and suggests alternative policy options and recommendations from the perspective of different circularity discourses (§ 4.5).

4.4 Results

4.4.1 EU circularity discourse

Figure 4.2 resumes the main keywords found for all the discourse types. It shows that the EU has taken an *optimist* approach to circularity, evidenced by a large number of keywords in the area of technology, growth and innovation (1477 in total), as opposed to planetary boundaries and collapse (491 in total).

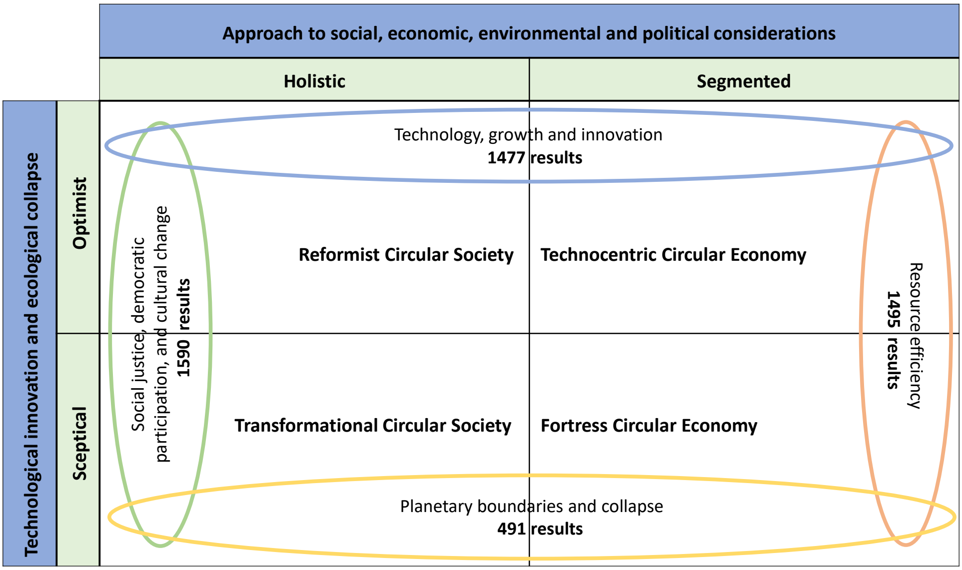


FIGURE 4.2 | Circularity discourse types and their main keywords results.

Looking into further detail on the query results shows that the EU does pay close attention to geostrategic resource security issues and seeks to build resilience, protect the EU from the scarcity of critical raw materials and address migration (see table 4.3). Nevertheless, an optimist approach towards economic growth, technological efficiency and innovative business models is clearly evidenced throughout the Commission's discourse with frequent keywords such as business* (218 results), artificial intelligence (34 results), growth (149 results), innovation (376 results), and efficien* (339 results), while various keywords reflecting planetary boundaries such as entropy, exhaustion, extinct*, overshoot*, overconsum* were not used at all (see table I in supplementary materials of Calisto Friant et *al.* (2021) for full query results)[35].

TABLE 4.3 | Keywords in *Sceptical* and *Optimist* discursive areas.

Area	Top 7 Keywords in each group	Count	Total Keyword count
Sceptical			
Planetary boundaries and collapse	risk*	170	**491**
	secur*	135	
	resilien*	48	
	"critical raw materials"	43	
	migra*	35	
Optimist			
Technology, growth and innovation	innovation	376	**1477**
	efficien*	339	
	technolog*	226	
	business*	218	
	growth	149	

The picture is a bit more complex when investigating the *holistic* and *segmented* differentiation as both discourse areas have a similar number of keyword results (see table 4.4). The EU includes many of the socio-political considerations of circularity with terms related to human health, stakeholder cooperation and employment appearing particularly often. Moreover, terms related to social justice, while less prevalent, are nonetheless important with keywords such as wellbeing (33 results), inequalit* (74 results), and fair* (59 results) appearing rather frequently (see table II I in supplementary materials of Calisto Friant et *al.* (2021) for full query results).

The EU also engages strongly with resource-efficiency narratives, with key attention to terms relating to recovery activities and waste management. Nonetheless, these do not prevail over other issues, showing the EU has a rather comprehensive discourse. It is, however, worth noting that the EU did not use several keywords related to cultural change such as localiz*, downscal*, convivial*, open source, commons and simple living/voluntary simplicity. This shows that, even though the Commission took a rather holistic approach, it did so in an uncontroversial and reformist manner, which did not challenge modernist

35 Keywords searched with an asterisk allow for the inclusion of all their relevant variations in query results.

worldviews and systemic socio-cultural structures that many see as the core elements of the present socio-ecological crisis (Beling et al., 2018; D'Alisa et al., 2014; Escobar, 2014; Kothari et al., 2014; Meadows, 1999).

TABLE 4.4 | Keywords in *Segmented* and *Holistic* discursive areas.

Area	Top 5 Keywords in each group	Count	Total Keyword count
Segmented			
Resource efficiency	recycling	407	**1495**
	repair*	248	
	"waste management"	172	
	reuse*	126	
	"energy efficiency"	74	
Holistic			
Social justice, democratic participation, and cultural change	health*	223	**1590**
	safe*	175	
	stakeholder*	123	
	cooperat*	118	
	job*	115	

To sum up, the EU's discourse can be described as moderately *holistic* and highly *optimistic*, which, overall, puts the EU in the *reformist circular society* discourse type.

4.4.2 Review of EU policy on the CE

This section of the results reviews the content of CE directives and regulations of the Junker Commission (2014-2019) to assess the EU's implementation of circularity.

4.4.2.1 Updated Waste Directives

Since the publication of the "Circular Economy Action Plan" in 2015, the EU has carried out a wide-ranging set of policy reforms.

The Landfill of Waste Directive and the Waste Framework Directive were amended to reduce landfilling and improve the recycling of waste (see Table 4.5 with the updated targets and measures).

The updated Waste Framework Directive (2008/98/EC) also requires member states to establish waste prevention programmes[36] which, must contain at least the following type of measures:

- Encouraging the manufacture and design of resource-efficient, durable, repairable, reusable and upgradable products.
- Ensuring the conservation of critical raw materials.
- Encouraging the re-use and repair of products, including the availability of spare parts and manuals.

36 Waste prevention programmes may be part of Member State Waste Management Plans or other environmental policy.

- Reducing industrial waste in extractive, manufacturing and construction sectors.
- Reducing food waste and fostering food donation.
- Reducing the content of hazardous substances in products as well as the generation of waste that cannot be reused, repaired or recycled.
- Identifying and preventing the main sources of harmful environmental littering, especially marine litter.
- Developing awareness-raising campaigns about littering and waste prevention.

TABLE 4.5 | Targets and measures of updated EU Waste Directives.

Target Year	2025	2030	2035	2018 levels (Eurostat 2020)
Directive (EU) 2018/851 amending Directive 2008/98/EC on waste	The preparing for re-use* and the recycling** of municipal waste is increased to 55 % by weight (Article 11.2).	The preparing for re-use* and the recycling** of municipal waste is increased to 60 % by weight (Article 11.2)	The preparing for re-use* and the recycling** of municipal waste is increased to 65 % by weight (Article 11.2)	EU municipal waste recycling rate: 47.5%
Directive (EU) 2018/850 amending Directive 1999/31/ EC on the landfill of waste		All waste suitable for recovery, shall not be accepted in a landfill (Article 5.3a)	Max amount of municipal waste landfilled is 10 % (Article 5.5)	EU landfill of waste rate: 24%

* Preparing for re-use = checking, cleaning or repairing waste products so they can be re-used without any other pre-processing.

** Recycling = reprocessing organic and non-organic waste materials for the original or other purposes. It does not include energy recovery nor backfilling operations and it is only counted when recycled or composted materials are actually re-used rather than simply reprocessed.

To implement these measures, the updated Directive requires the establishment of economic instruments including, but not limited to: landfill charges, pay-as-you-throw systems, extended producer responsibility (EPR) systems, deposit-refund schemes, green public procurement (GPP), phasing-out unsustainable subsidies, supporting the development of CE technologies, and fiscal incentives for recovered or re-used products and materials (Annex IVa and IVb). Moreover, these Waste Prevention Programs must be elaborated with some level of public participation and cooperation (Article 31).

The directive also establishes renewed requirements for EPR schemes so that they operate more effectively, transparently and democratically. In line with the polluter pays principle, the amended Directive mandates that EPR systems must fully cover the costs of the separate collection, transport, treatment and recovery of waste as well as reporting and data gathering costs (Article 8a). It also encourages the use of eco-design policies, which account for the impact of products throughout their lifecycle (Article 8.2). Furthermore, the Directive requires EPR systems to have transparent governance structures with clear roles and responsibilities and regular dialogues between relevant stakeholders from the private, public and social sectors, including social economy actors repair networks and recyclers (Article 8a).

In addition to this, the amended Waste Framework Directive restricts the export of waste by reversing the burden of proof so the exporter must show that the waste is properly managed to count as "recycled" (Article 11a.8).

4.4.2.2 Updated Packaging Directive

The updated Packaging Directive establishes renewed recycling targets for different types of packaging waste (see table 4.6) and mandates the establishment of extended producer responsibility schemes for all packaging by the 31st of December 2024 (Article 7.2). It also requires member states to establish general preventive measures to minimise waste generation and encourage the use of reusable packaging (Articles 4 and 5).

TABLE 4.6 | Targets and measures of the updated packaging and packaging waste Directive.

Target Year	2025	2030	2017 levels (Eurostat 2020)
Directive (EU) 2018/852 amending Directive 94/62/EC on packaging and packaging waste	65 % of all packaging waste recycled as well as: (i) 50 % of plastic packaging; (ii) 25 % of wood packaging; (iii) 70 % of ferrous metal packaging; (iv) 50 % of aluminium packaging; (v) 70 % of glass packaging; (vi) 75 % of paper and cardboard packaging (Article 6.1)	70 % of all packaging waste recycled as well as: (i) 55 % of plastic packaging; (ii) 30 % of wood packaging; (iii) 80 % of ferrous metal packaging; (iv) 60 % of aluminium packaging; (v) 75 % of glass packaging; (vi) 85 % of paper and cardboard packaging (Article 6.1)	EU recycling rate for all packaging waste: 67.5% Plastic packaging: 41.7% Wood packaging: 41.2 % Metal packaging: 80.7 % Glass packaging: 75.9% Paper and cardboard packaging: 85.5%

4.4.2.3 New policies for plastics

The Directive on the Reduction of the Impact of Certain Plastic Products on the Environment (EU 2019/904), places a set of measures on single-use plastics (SUPs) which are resumed in Table 4.7. The Directive bans several SUPs including cotton buds, cutlery, stirrers, plates and straws (Article 5). For other SUPs the Directive places consumption reduction measures, for which member states must achieve a measurable reduction in their consumption by 2026 compared to 2022, but the EU does not prescribe specific measures to reach this objective (Article 4). The Directive also mandates that by July 2024, SUP bottles must have caps and lids that stay attached to the containers to avoid losses and facilitate recycling. Moreover, all SUP bottles have separate collection targets (Article 7) and those made of PET (Polyethylene Terephthalate) have additional targets regarding their recycled plastic content (Article 6). Beverage cups, tobaccos, wet wipes and sanitary towels must include clearly legible markings informing consumers of the appropriate and inappropriate waste management options, as well as the ecological impact of mismanaged plastic (Article 7). For all SUPs, which are not directly banned by the Directive, EPR systems must be established, and awareness-raising measures must be put in place to encourage reusable alternatives and reduce litter (Articles 8 and 10).

TABLE 4.7 | Measures in the EU Directive on single-use plastics.

Measures for SUPs by plastic type	Consumption reduction	Market restriction	Product design requirement	Marking requirement	Extended Producer Responsibility	Separate collection objective	Awareness-raising measures
Cotton bud sticks		Ban by July 3rd 2021					
Cutlery, plates, stirrers, straws							
Sticks for balloons							
Oxo-degradable plastics							
Containers made of expanded polystyrene							
Beverage containers, their caps & lids			PET SUP bottles must contain 25 % recycled plastic by 2025 and 30% by 2030. Caps and lids must remain attached to bottles		EPR systems must be established by the 31st of December 2024 in line with the requirements of Directive 2008/98/EC. Moreover, new EPRs must pay for awareness-raising measures of this directive	77% by 2025 and 90% by 2029	Must incentivise responsible consumer behaviour by informing on re-usable alternatives, the environmental impacts of SUP, and the best waste management options
Food containers	Each MS must establish measures						
Cups for beverages				Markings on waste treatment options and environmental impacts of waste must be placed by July 3, 2021			
Tobacco product filters							
Wet wipes							
Sanitary towels							
Lightweight plastic carrier bags							
Fishing gear							

To deal with other plastics, the Commission has focused on establishing a voluntary pledge with industry instead of imposing a target on the use of secondary plastic in new products. The Commission thus created a Circular Plastics Alliance with industry partners, which committed to ensuring that 10 million tonnes of recycled plastics are used to make new products in the EU by 2025 (in 2016 less than 4 million tons of recycled plastics were sold in Europe, just 8% of the market) (European Commission, 2021).

4.4.2.4 Eco-design policies

The Ecodesign Directive (2009/125/EC) has not been amended but the Ecodesign Working Plan (2016-2019) incorporates circularity criteria along with energy, noise, and water efficiency regulations. New ecodesign regulations were hence adopted in 2019 after consultation processes with recyclers and producers (Talens Peiró et al., 2020) and will enter into force between 2020 and 2021. The updated regulations include the following resource efficiency requirements for 7 of the 28 product groups covered by the EU's eco-design regulations (refrigerators, dishwashers, electronic displays, washing machines, welding equipment and servers and data storage products):

- Key spare parts must be easily available to professional repairers for a minimum period of 7 to 10 years after placing the last unit on the market.
- Spare parts must be replaceable with commonly available tools.
- The repair and maintenance information must be available to professional repairers for a reasonable and proportionate fee.
- The delivery of spare parts must take a maximum of 15 working days.
- Some components must be marked with a visible sign to facilitate their recycling such as certain polymers, flame retardants, and critical raw materials.
- The latest version of the firmware must be available for at least 8 years, free of charge or at a fair, transparent and non-discriminatory cost. The latest security update to the firmware must be available free of charge for at least 8 years.

4.4.2.5 Monitoring framework

To track the circularity transition, the Commission has established a set of indicators in its COM(2018)29 "on a monitoring framework for the circular economy" (see table 4.8). Most indicators are shared with the EU's Resource Efficiency Scoreboard and the Raw Materials Scoreboard (Moraga et al., 2019). As can be seen from Table 4.8, the vast majority of indicators don't have respective targets or policy actions, which limits them to a purely informative role.

TABLE 4.8 | EU CE indicator framework and respective EU actions and targets.

Indicator	
1. EU self-sufficiency for raw materials (%)	
2. Green public procurement (GPP)	
3. Waste generation	3a. Generation of municipal waste per capita (kg per capita)
	3b. Generation of waste excluding major mineral wastes per GDP unit
	3c. Generation of waste excluding mineral wastes per domestic material consumption (%)
4. Food waste (million tonnes)	
5. Overall recycling rates	5a. Recycling rate municipal waste (%)
	5b. Recycling rate excluding major mineral waste (%)
6. Recycling rates for specific waste streams	6a. Overall packaging (%)
	6b. Plastic packaging (%)
	6c. Wooden packaging (%)
	6d. E-waste (%)
	6e. Bio-waste (%)
	6f. Construction and demolition waste (%)
7. Contribution of recycled materials to raw materials demand	7a. End-of-life recycling input rates (EOL-RIR)[37] (%)
	7b. Circular material use rate[38] (%)
8. Trade in recyclable raw materials	Imports from non-EU countries (tonnes)
	Exports to non-EU countries (tonnes)
	Intra-EU trade (tonnes)
9. Private investments jobs and gross value added	9a. Gross investment in tangible goods (% GDP)
	9b. Persons employed (% of total employment)
	9c. Value-added at factor cost (% of GDP)
10. Patents	Number of patents related to recycling and secondary raw materials

Source: Adapted from COM(2018) 29 and Pardo and Schweitzer, (2018), figures in the last column from Eurostat, (2020).

37 Measures, for a set of specific critical raw materials, how much of their input into the production system comes from recycling of "old scrap".

38 Share of material recovered and fed back into the economy as % of overall material use, for all material types.

Relevant EU Targets or Actions	Latest figures
None	N/A
Only an indicative 50% GPP target (COM/2008/400)	N/A
No targets but Member State's waste prevention programmes are encouraged to include measures in this regard	492 kg/capita (2018)
	66 kg per thousand euros (2018)
	12.8% (2018)
The EU has committed to SDG 12.3 to halve per capita food waste by 2030 but has no binding target	70 million tonnes (2016)
Recycling targets and measures set in Directive (EU) 2018/851 (see table 4.5)	47.5% (2018)
No explicit targets or actions.	56% (2016)
Recycling targets and measures set in Directive (EU) 2018/852 (see table 4.6)	67% (2017)
	41.7% (2017)
	41.2% (2017)
Target of Directive (2012/19/EU): 65% collection rate by 2019	34.8% (2018)
No explicit target but Bio-waste must be separated and recycled at source or separately collected by end of 2023 Directive (EU) 2018/851, article 22:	83 kg/capita (2018)
Target of old Waste Framework Directive (2008/98/EC): 70% of construction and demolition waste recycled or recovered (including backfilling) by 2020	87% (2016)
No targets but member states are encouraged to develop measures to increase the share of secondary materials in total material demand	N/A
	11.2% (2017)
No targets, limited strengthening of export requirements outside the EU (Directive (EU) 2018/851) and facilitation of trade of fertilizers within EU Regulation 2019/1009	8.9 million tonnes (2019)
	25.5 million tonnes (2019)
	47.9 million tonnes (2019)
No targets, but some financial mechanisms in place to help transitionto a CE (10 billion invested from 2015 to 2019)	0.12% (2017)
	1.72% (2017)
	0.96% (2017)
	337 patents (2015)

4.4.3 Critical analysis

This section analyses the results presented in sections 4.4.1 and 4.4.2 by comparing the EU's discourse and policies on circularity. It uses the typology of circularity discourses (table 4.1) as the basis of this critical reflection to better map and contrast the EU's words and actions.

4.4.3.1 Reformist circular society discourse

What is most significant in the results from the keyword queries was perhaps not the terms used by the EU, but those that it deliberately and strategically chose not to mention. As Foucault states: "*manifest discourse […] is really no more than the repressive presence of what it does not say; and this 'not-said' is a hollow that undermines from within all that is said*" (Foucault, 1972: p.25). The "not-said" is precisely what is most telling as the EU has chosen not to talk of rebound effects, entropy, overshoot, overconsumption and downscaling (see § 4.4.1). This discourse thus allows for the positioning of what Lazarevic and Valve (2017) call a "*deliberately vague, but uncontroversial, circular economy*" (p.67).

Results demonstrate that the EU gives disproportionate attention to the technical and economic considerations of circularity, especially compared to cultural aspects and lifestyle transformations (see tables 4.3 and 4.4). The CE is thus viewed as an avenue for "green growth" and the decoupling of economic growth from environmental degradation. Indeed, the EU states that "*green growth would 'lift all the boats'*" (COM(2019) 22 p.14) and mentions 11 times that decoupling is happening or is being actively pursued (see table I in the supplementary materials of Calisto Friant et al. (2021)).

While some social matters are addressed, such as the need to reduce inequalities, this is conditioned on having a growing economy: "*member states will work towards ensuring inclusive and sustainable growth in the EU, a necessary condition to reduce inequality*" (COM(2019) 22 p.96). Hence inequality reductions are only envisaged by better distributing future economic benefits and not by redistributing present wealth. Moreover, this presupposes that social equity can only be improved when the GDP increases, which assumes the capacity of the biosphere to sustain further economic growth, despite mounting evidence of the contrary (Hickel and Kallis, 2019; Jackson, 2016; Parrique et al., 2019; Ward et al., 2016).

This is very much in line with *reformist circular society* discourses, which assume the possibility of eco-economic decoupling and promote a continued era of green growth and eco-innovation to improve human well-being and environmental sustainability (see table 4.1).

4.4.3.2 Technocentric circular economy policies

The review of EU CE policies shows a clear focus on resource efficiency and technological change as an avenue for circularity. Indeed, most measures and almost all targets are aimed at improving the recycling of different types of waste (R7). Repairing (R3) is also promoted by the updated ecodesign regulations, but it only affects a limited number of electronic products, and there are no targets or indicators for repair activities. The most ambitious policies relate to SUP with some bans (R0 refuse) as well as consumption reduction and awareness-raising measures (R1 reduce). Yet they only apply to a limited number of plastic products.

While Waste Prevention Programs must now include some high-value retention options such as reduction (R1), reuse (R2) repair (R3), upgradability (linked to R4 refurbish) and remanufacture (R5) policies no specific targets or obligations are placed for those. Therefore, the precise measures for those aspects of circularity are left to the discretion of member states, which don't have an incentive to make stringent requirements as they can hamper the competitiveness of their economies in the single market. Therefore, while some R0 to R5 policies are pursued, the majority of constraining policy objectives and measures are geared towards R7 (recycling), which is the value retention focus of *technocentric circular economy* visions (see table 4.1).

Furthermore, the governance implications of the CE are only partly dealt with through the requirement that Waste Prevention Programs must be elaborated with some level of stakeholder cooperation and participation and the need for EPR systems to have transparent governance structures and dialogues with relevant social stakeholders (see § 4.4.2.1).

The EU's CE policies don't include measures directed specifically at social and cultural aspects of circularity such as open-source technologies, sustainable sourcing of materials, promotion of social and solidarity economies, etc. On the cultural side, only some awareness-raising measures are established in Directives 2018/851 and 2019/904, but they are rather limited as they focus on reducing littering rather than challenging overconsumption and materialism.

In line with *technocentric circular economy* discourses (see table 4.1), the EU thus implements a depoliticized vision of circularity, where equity in the ownership of circular technology and fairness in the distribution of its benefits is not addressed, and one where participation amounts to little more than public consultation and information. It is a circularity policy that assumes the possibility of decoupling between economic growth and environmental destruction, and a CE without trade-offs and compromises in the complex nexus between water, food, land, energy, and materials. The EU's CE measures are thus mainly updates of old waste policies from the late 1990's early 2000's (such as Directives 2008/98/EC on waste, Directive 94/62/EC on packaging and packaging waste, and Directive 1999/31/EC on the landfill of waste), which represent *technocentric* visions that mainly seek to increase recycling rates rather than building transformative change that would shrink, slow, localize, redistribute and democratise resource cycles (Farmer, 2020; Fitch-Roy et al., 2020; Homrich et al., 2018; Moraga et al., 2019).

The results of this research are in line with the observations of various scholars (Colombo et al., 2019; Fitch-Roy et al., 2020; Knill et al., 2020; Lazarevic and Valve, 2017; Pollex and Lenschow, 2018; Repo et al., 2018; Stegemann and Ossewaarde, 2018; Völker et al., 2020), which found that the EU has had a weak sustainability vision through eco-modernist discourses and policies, which focus on techno-innovations, green growth and competitiveness rather than reducing the EU's ecological footprint.

4.4.3.3 Talk versus Action

From the above results, one can conclude that there is a dichotomy between EU discourse (talk) and EU policies (actions) on the CE. Referring back to the circularity discourse matrix (see table 4.1 and Figure 4.1), EU talk is in the *optimist* and *holistic* framing of *Reformist Circular Society* discourses, while EU action falls within the *segmented* and *optimist* typology of *technocentric circular economy* discourses (see Figure 4.3).

		Approach to social, economic, environmental and governance considerations	
		Holistic	**Segmented**
Technological innovation and ecological collapse	**Optimist**	**EU "Talk"** The discourse includes social and environmental aspects. Many topics are covered but with a focus on competitiveness, eco-innovation and green growth.	**EU "Action"** Targets and measures based mostly on resource efficiency and waste management with only basic participatory and cultural elements, and no social justice components.
	Sceptical		

FIGURE 4.3 | Circularity talk and action of the EU.

This dichotomy between discourse and policy is in line with the findings of Fitch-Roy, Benson, and Monciardini (2019) who found that the EU's CE policies merely place "*old wine in new bottles*" (p.996) by updating waste directives and recycling targets rather than seeking further transformative change. These findings are also in line with those of Knill, Steinebach, and Fernández-i-Marín (2018), who evidenced a "hypocrisy" (p.375) between EU environmental talk and action from 2000 to 2016. As they point out, this is most probably caused by the Commission's strategy to retain its image as an active environmental policy entrepreneur, while also slowing down on environmental regulations to focus on economic growth in a time of economic recovery and stagnation (Knill, Steinebach, and Fernández-i-Marín 2018). Thus, it is very likely that the Commission continued the same strategy, and, considering that it received the Circulars Award at the World Economic Forum in 2019, this appeared to have paid off.

4.5 Discussion and recommendations

This section critically discusses the key limitations and implications of the EU's CE policy direction from the perspective of other circular visions to propose alternative pathways to a sustainable circular future.

4.5.1 Targets and indicators

Of the set of policy targets and indicators chosen by the EU to measure and foster the transition to circularity, only one relates to a social dimension (the employment indicator in the CE Monitoring Framework (COM(2018) 29). Yet, this indicator has no mandatory target nor accompanying policy or regulatory measure, so it is only used for monitoring purposes.

A *holistic* vision of circularity would have promoted many mandatory targets including, but not limited to, job generation, investments in the social and solidarity economy, number of cooperatives and social enterprises working on circularity, wealth and income Gini indexes, and percentage of consumption of products with recognized socio-ecological certification programs[39]. A *holistic* vision would also establish bans on destroying unsold stocks and set higher restrictions on waste exports outside the EU (or even bans for certain high-risk materials), as they not only cause high transport emissions but also move the problem away to areas of the world which are poorly equipped to manage waste, thus creating considerable impacts to human health and natural ecosystems (Bishop et al., 2020).

Furthermore, except for the two indicators of the CE Monitoring Framework on end-of-life recycling input rates and circular material use rate (see § 4.4.2.5.), there are no other indicators or policy measures to incentivise a reduction of the linearity of the EU's economy at a macro level. Many academics have pointed out that any CE policy should ultimately seek to reduce the overall footprint of human activities and bring our socio-economic system in line with the biophysical boundaries of the earth (Arnsperger and Bourg, 2017; Junnila et al., 2018; Lehmann et al., 2018; Rijnhout et al., 2018; Vita et al., 2019). The EU currently has a material footprint per capita between 40 and 50 tons per year, way beyond a scientifically recognized sustainable level of around 7 to 8 tons per capita per year (Hickel, 2020a; Hickel and Kallis, 2019; Mont et al., 2014; Rijnhout et al., 2018). A reduction of over 80% is thus required for Europeans to live within the biophysical limits of the earth, and it is key for any circularity policy to go in this direction. However, research on eco-economic decoupling has clearly evidenced that achieving such a reduction in material footprint, while also growing GDP per capita is impossible (Albert, 2020; Haberl et al., 2020; Hickel and Kallis, 2019; Pardo and Schweitzer, 2018; Parrique et al., 2019). Despite this inconsistency between ecological imperatives and continued economic growth, the EU has chosen a *technocentric* discourse championing the CE Action Plan as a way to "unlock the growth and jobs potential of the circular economy" (Preamble, COM(2015) 614, p.2) and decouple

39 Such as the certifications which are members of the ISEAL Alliance like Fairtrade, MSC and FSC (Vermeulen, 2015)

economic growth from environmental degradation. From a *sceptical* position on circularity, many other targets and indicators would thus be necessary, such as targets to reduce per capita waste generation, per capita material demand and per capita ecological footprint, as well as goals on increased self-sufficiency on raw materials.

Another issue is that there are no targets for the use of secondary materials in new products, except for SUP bottles and the voluntary commitments of the Circular Plastics Alliance (see § 4.4.2.3). Mandatory recycled content targets could boost the demand for recovered plastics which are currently facing considerable price and market barriers (Baran, 2020; Elliott et al., 2020; Milios et al., 2018). Facilitating the establishment of EU-wide online platforms for the trading of circular goods (recycled materials, recovered components, repurposed products, second-hand goods etc.) would also be beneficial in this regard (K. Hartley et al., 2020).

Another limitation of the EU's targets is that many member states might choose to incinerate a large amount of their waste to meet the new 10% landfill target (see § 4.4.2.1). This could lead to higher greenhouse gas emissions and to sub-optimal uses of potentially re-usable, recyclable or compostable resources. Settings limits to total energy recovery rates or stronger restrictions on the incineration of recyclable wastes could address this issue (Milios et al., 2018).

4.5.2 Eco-design

The revised ecodesign regulations are geared towards repairability and recyclability, as they increase the availability of spare parts and the ease of disassembly of these products. From a *sceptical* and *holistic* circularity perspective, these regulations would also have to encourage other value retention options (especially R0-R5) through measures that require improved product durability, multifunctionality, upgradeability, and modularity. They would also need to reduce the overall ecological footprint of products by establishing mandatory product passports and sustainability labels (such as socio-ecological impact labels) as well as compulsory information on product durability (Pardo and Schweitzer, 2018).

From a *circular society* perspective, other policies would have been necessary, such as making repair manuals completely free and open-source (and not just available to professional repairers at a fee), as well as promoting open source innovation, such as mandating that all hardware and software from discontinued products must become open-source. Increasing minimum mandatory guarantee periods from 2 to 3 or more years would also be necessary, as academics (Bihouix, 2014; Latouche, 2009; Lazarevic and Valve, 2017) and consumer groups have been asking[40].

The measures adopted by the Commission don't reduce the high cost of repairs, which incentivises the purchase of new products. Key measures in this regard would be a reduction of Value-Added Tax (VAT) for reused, remanufactured, refurbished and repaired goods (and

40 Based on the presentation of Euroconsumers on the 6th of Martch at the 2019 Circular Economy Stakeholder Conference in Brussels.

repair services) (K. Hartley et al., 2020) as well as establishing subsidies for repair services to help low-income groups (Bihouix, 2014).

Finally, it is worth noting that the eco-design regulations only apply to large electronic goods, with rather long lifespans such as washing machines, refrigerators and dishwashers. Fast-moving consumer electronics, such as mobile phones, tablets and computers, should have been included to expand the scope and impact of the EU's eco-design requirements.

4.5.3 Economic incentives

The EU broadly encourages pay-as-you-throw systems, fiscal incentives for food donations, deposit-refund schemes, ending fossil-fuel subsidies, taxing virgin materials, and lower VATs on recycled, repaired, remanufactured or refurbished goods. However, none of these measures is mandatory (see § 4.4.2.1.). Thus, subsidies for fossil fuels amongst EU member states have actually risen by 3% between 2008 and 2016, reaching a total of €55 billion a year in 2017 prices (Rademaekers et al., 2018). This dwarfs the Commission's investments in the CE, which amounted to 10 billion euros between 2016 and 2019 (COM 2019/190). Most member states have no plans to reduce their subsidies despite EU recommendations (Rademaekers et al., 2018). Furthermore, taxes for rail transport remain higher than for road and air in most EU member states, which further inhibits a transition to a zero-carbon circular future (Rijnhout et al., 2018).

Holistic and *sceptical* circularity positions would have sought much stronger measures to transform fiscal policy so resources (especially raw materials) are taxed instead of labour (Antikainen et al., 2018; Arnsperger and Bourg, 2017; Lazarevic and Valve, 2017; Stahel, 2010; von Weizsäcker and Wijkman, 2017). Eliminating financial paradises and establishing EU-wide taxes on wealth and financial transactions are also seen as key measures to fund a fair and equitable ecological transition (Piketty, 2019; Schratzenstaller and Krenek, 2019). Mandatory circular and green public procurement requirements should also be established to foster circular innovations by mobilizing the €2 trillion euros spent annually on public procurement in the EU (K. Hartley et al., 2020; Milios, 2018). However, fiscal matters require unanimity in the European Council, and this might very well be the limiting factor for this kind of action. Nevertheless, as long as the price signals favour linear models, circular options will likely remain niche sectors of the economy. In fact, recent reviews of the major barriers for the CE found that market and financial factors, such as low virgin material prices and lack of fiscal incentives, pose some of the largest barriers to a circularity transition (de Jesus et al., 2019; de Jesus and Mendonça, 2018; Kirchherr et al., 2018; Milios et al., 2018).

The above point also demonstrates the need to democratize the EU's decision-making structure to better address the key socio-ecological challenges of the 21st century through policies such as increasing transparency, improving decision-making procedures, and establishing a citizen assembly of randomly selected EU citizens with tangible powers on European socio-ecological policies (Kamlage and Nanz, 2017).

4.5.4 Awareness raising and over-consumption

The awareness-raising obligations of the new circularity Directives stress recycling and adequate disposal rather than consumption reduction and lifestyle change. As Bihouix (2014), Monsaingeon (2017) and Valenzuela and Böhm (2017) argue, this discourse of circularity through waste management creates the illusion that the present sustainability crisis can be overcome by recycling alone. Yet, as we know from the laws of thermodynamics, there are inevitable losses in quality and quantity in any recovery process which means it can only supply a fraction of overall material demand (Cullen, 2017; Giampietro, 2019; Skene, 2018). Recycling alone is thus far from enough to address the current overconsumption of natural resources and overshoot of planetary boundaries (Bruel et al., 2019; Giampietro, 2019; Korhonen et al., 2018a; Reuter et al., 2019; Skene, 2018; Zink and Geyer, 2017). It is thus key not only to recycle but to also reduce overall material consumption and economic growth (Arnsperger and Bourg, 2017; Fressoz and Bonneuil, 2016; Lorenz et al., 2018; Mayumi and Giampietro, 2019; Millar et al., 2019).

Promoting awareness-raising without touching on marketing and advertising, which is building demand for conspicuous consumption, is thus a missed opportunity for transformative change. Indeed, no matter how eco-efficient a product is, its impact will always be greater than if it wasn't produced in the first place (Bihouix, 2014; Hickel, 2017; Korhonen et al., 2018a). From a *sceptical* and *holistic* perspective on circularity, it would have been key to promote non-material aspirations through policies, such as taxes on advertisements, bans on commercials for ecologically harmful goods such as SUVs and reducing working hours to 30 or less per week (Arnsperger and Bourg, 2017; Ashby et al., 2019; Cosme et al., 2017; Latouche, 2009; Pollex and Lenschow, 2018). Moreover, encouraging convivial (Caillé, 2019) and "frugally abundant" lifestyles (Latouche, 2009), with a greater connection to both nature and other peoples, can significantly improve quality of life, health and wellbeing (Alexander, 2015; Caillé, 2015; D'Alisa et al., 2014; Escobar, 2018; Kallis et al., 2018; Kothari et al., 2019; Latouche, 2018; Raworth, 2017).

4.5.5 Biodiversity and energy

Following a *technocentric circular economy* perspective, the EU has treated circularity, energy and biodiversity as separate issues. However, they form a deeply interrelated nexus, and actions taken in one area will enviably affect the other (Antikainen et al., 2018; Bleischwitz and Miedzinski, 2018). Moreover, as Repo et al. (2018) have found, citizen groups already see the circularity transition as an integral element of the energy and ecological transition. The need to closely integrate EU environmental policies on energy, biodiversity, and circularity into a holistic and coherent strategy has also been argued by many academics (Kaźmierczyk, 2018; McDowall et al., 2017; Milios, 2018; Repo et al., 2018; Rijnhout et al., 2018; Wuttke, 2018).

The EU currently has no targets or indicators linking its CE strategy to its biodiversity strategy and there is a deep necessity to do so as we are now in the midst of a biodiversity crisis on the scale of a mass extinction event (IPCC, 2019; von Weizsäcker and Wijkman, 2017). The midterm review of the EU's Biodiversity Strategy (COM/2015/0478) found that its headline target to "halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020" will most likely not be reached. In fact, biodiversity is continuously decreasing throughout the EU due to the destruction of habitats, the rise in artificial surfaces, the impacts of industrial agriculture and the gross overexploitation of marine resources (Krämer, 2019). A review of the Common Agricultural Policy is key to reduce this trend, especially if a *holistic* approach is taken that subsidises farmers based on the social and ecological services they provide to their communities rather than based on the size of their farms (De Schutter, 2019; Frantzeskaki et al., 2019; Scown et al., 2020; Wieliczko, 2019). Setting mandatory targets to reduce food waste and promoting healthier plant-based diets are also key in this regard as food waste and meat production have significant impacts on climate change and biodiversity (Allen and Hof, 2019; Niles et al., 2018; Springmann et al., 2018; Stoll-Kleemann and Schmidt, 2017; Vita et al., 2019).

On a positive note, it is worth noting that the EU has already reached its 2020 goal for a 20 % reduction in EU greenhouse gas emissions from 1990 levels, and will likely reach its 40% goal for 2030 (Krämer, 2019). Discussions in the EU are carried out in 2020 to establish a European Green Deal with a 2050 climate neutrality target (Von Der Leyen, 2019). These steps are important, but according to many civil society organizations, this is not enough, as they seek a 2040 target for net-zero emissions to keep the earth within the goal of limiting temperature rise to 1.5 degrees Celsius as established in the Paris Climate Agreement (CAN, 2018; Greenpeace, 2018; WWF, 2018). Other citizen groups demand an even earlier 2025 date to reach both net zero-emissions and net-zero biodiversity loss (Extinction Rebellion, 2019). Recent academic research finds that, to achieve the Paris Agreement targets, climate neutrality must be reached between 2030 and 2040 (Hickel and Kallis, 2019; Höhne et al., 2019; Nieto et al., 2019). These dates are closer to some civil society demands than to current EU policies. Moreover, various academics have also suggested that the scale and speed of this transition means that the Paris Agreement objectives can most likely only be achieved through a post-growth strategy (Jackson and Victor, 2019; Nieto et al., 2019). This questions the EU's insistence on the CE as an avenue for low-carbon economic growth.

On the other hand, the CE can play a key role in a zero-carbon ecological transition as production and consumption processes account for 45% of greenhouse gas emissions (GHG) (the other 55% corresponds to energy provision) (Ellen MacArthur Foundation and Material Economics, 2019). Recycled materials generate much less GHG emissions than virgin ones (Aurez et al., 2016), and eliminating landfilling and reducing food waste can significantly reduce GHG emissions (Hawken, 2017; Jurgilevich et al., 2016). Moreover, reducing demand for goods through longer use rates and simple living and convivial lifestyle transformations is key to reducing GHG emissions (Bengtsson et al., 2018; Nieto et al., 2019; Vita et al., 2019). Furthermore, regenerative agriculture and agroecology can create circular food systems with significant climate change mitigation and adaptation benefits (Del Borghi et al., 2020; Jurgilevich et al., 2016; Reynaud et al., 2019). Nonetheless, a mismanaged CE transition could also hamper mitigation targets by overly relying on energy recovery, biofuels and bio-materials, which generate substantial amounts of GHG emissions and increase the land-use change pressure on biodiversity (Bihouix, 2014; Heck et al., 2018).

Moreover, energy is needed to recycle any end-of-life product or material. A CE can thus increase the demand for high-temperature heat, which is hard to obtain from renewable sources of energy (Cullen, 2017). To manage these complex trade-offs and synergies, it is key to integrate the climate, ecological and circularity transitions from a holistic perspective. Policies, in this regard, are lacking at the EU level (Kaźmierczyk, 2018; Repo et al., 2018; Rijnhout et al., 2018; Wuttke, 2018) and could include carbon tariffs for imported goods, and consumer taxes based on the ecological footprint of products as well as redistributive policies to ensure that the economic burden does not fall on the most vulnerable (Arnsperger and Bourg, 2017; Frantzeskaki et al., 2019; Piketty, 2019; Vita et al., 2019). Increased financing and technology transfer to the Global South for climate change, biodiversity and circularity projects would also be required from a *holistic* perspective to facilitate the global ecological transition.

4.5.6 Towards a plural policy mix

This chapter has presented a total of 32 alternative policy options to improve the EU's CE package from a plural perspective that goes beyond its current *technocentric circular economy* focus. The full list of policy suggestions is presented in table 4.9, which classifies each policy based on the value retention option it focuses on. The diversity of policy recommendations derived from this research address all 10Rs, including the highest and most sustainable Rs in the value retention hierarchy (R0-R6) (Reike et al., 2018a). This demonstrates that a plural understanding of the topic, which embraces the perspective of many alternative circularity visions, can lead to a more comprehensive policy approach compared to the package of the Junker Commission, which disproportionally focuses on R7. Furthermore, some recommendations go beyond the 10Rs by adding key social justice and fairness elements, which are essential components of a circularity transition, yet remain ill-recognised by the literature (Hobson and Lynch, 2016; Millar et al., 2019; Moreau et al., 2017; Temesgen et al., 2019).

TABLE 4.9 | Policy alternatives based on a plurality of circularity visions.

R-focus	Circularity discourse	Policies	Discussed in §
R8	All	Establish limits to total energy recovery rates and/or stricter restrictions on the incineration of recyclable, re-usable or compostable wastes	4.5.1
R7-9	RCS and TCS	Heavily restrict or ban the export of waste outside the EU	4.5.1
R4-7	All	Ban the destruction of unsold stocks	4.5.1
R4-7	All	Establish a mandatory product passport with information on all materials and components to facilitate product and material recovery	4.5.2
R3-7	All	Expand eco-design regulations to fast-moving consumer electronics such as mobile phones, tablets and computers	4.5.2
R3-6	RCS and TCS	Promote open-source innovation (e.g. by mandating that all hardware and software from discontinued products becomes open source)	4.5.2
R3	RCS and TCS	Improve eco-design regulations to ensure repair manuals are completely free and open-source	4.5.2
R3	RCS and TCS	Establish subsidies for repair services to help low-income groups	4.5.2
R2-9	All	Establish EU-wide online platforms for the trading of secondary materials and products	4.5.1
R2-6	All	Reduce VAT for reused, remanufactured, refurbished and repaired goods and repair services	4.5.2
R1-8	RCS and TCS	Tax resources (especially raw materials) instead of labour	4.5.3
R1-8	All	Eliminate subsidies on fossil fuels	4.5.3
R1-7	TCE, RCS and TCS	Establish mandatory circular and green public procurement targets and requirements	4.5.3
R1-7	All	Establish targets on the percentage of secondary materials or sustainable renewable materials in new products and buildings	4.5.1
R1-5	All	Improve eco-design regulations by adding measures on product durability, multifunctionality, upgradeability, and modularity	4.5.2
R1-3	RCS and TCS	Increase minimum mandatory guarantee periods	4.5.2
R1	All	Establish mandatory targets to reduce food waste	4.5.5
R0-7	TCS and FCE	Establish targets to reduce per capita waste generation, per capita material demand and per capita ecological footprint, and to increase self-sufficiency in raw materials	4.5.1
R0-1	RCS and TCS	Revise the Common Agricultural Policy to subsidise farmers based on the social and ecological services they provide	4.5.5
R0-1	RCS and TCS	Mandate compulsory information on product durability, especially for electronic goods	4.5.2
R0-1	RCS and TCS	Establish mandatory sustainability labels (with product socio-ecological impact)	4.5.2
R0-1	RCS and TCS	Promote healthier plant-based diets	4.5.5
R0-1	TCS	Taxes on advertisements and bans on commercials for ecologically harmful goods such as SUVs	4.5.4
R0-1	TCS and FCE	Establish carbon tariffs for imported goods	5.5
R0-1	RCS and TCS	Update consumer taxes (VAT) based on the socio-ecological footprint of products	4.5.5

R-focus	Circularity discourse	Policies	Discussed in §
R0	TCS	Promote non-material aspirations and values and slower, and more convivial ways of life to improve human wellbeing while reducing material consumption	4.5.4
Beyond Rs	TCS	Reduce working hours to 30 or less per week	4.5.4
Beyond Rs	RCS and TCS	Establish targets on social aspects of circularity (e.g., job generation, investments in cooperatives and social enterprises working on CE, and percentage of consumption with a recognized socio-ecological certification program)	4.5.1
Beyond Rs	RCS and TCS	Democratize the EU's decision-making structure by increasing transparency, improving decision-making procedures and establishing an EU-wide citizens' assembly	4.5.3
Beyond Rs	RCS and TCS	Develop redistributive policies to ensure that the economic burden of a circularity transition does not fall on the most vulnerable	4.5.5
Beyond Rs	RCS and TCS	Eliminate financial paradises and establish EU-wide taxes on wealth and financial transactions	4.5.3
Beyond Rs	RCS and TCS	Increased financing and technology transfer to the Global South for climate change, biodiversity and circularity projects	4.5.5

RCS = Reformist Circular Society **TCS** = Transformational Circular Society
TCE = Technocentric Circular Economy **FCE** = Fortress Circular Economy
R0-10 = Value retention focus of each policy option based on R-hierarchy developed by Reike et al., (2018)
Beyond Rs = Policy option addresses socio-ecological concerns, which are beyond the value-retention hierarchy

4.6 Conclusion

Considering the complexity of policymaking between 28 sovereign states, the CE policies that the Commission has managed to pass are quite an achievement. The EU's circularity train has been started, with lots of expectations on its social, environmental and economic benefits. Yet, more holistic long-term thinking will be needed, to ensure that EU policies don't remain stuck in end-of-pipe solutions and actually bring about tangible socio-ecological change.

The EU's focus on closing resource cycles will without a doubt create an unprecedented boost for the recycling industry. However, this t*echnocentric circular economy* perspective will not significantly contribute to the shrinking, slowing, redistributing and democratizing of resource cycles. Most importantly, by focusing on growth and competitiveness rather than human well-being and ecosystem health, the EU might be creating new business opportunities for some, while doing little towards addressing the core socio-ecological challenges of the 21st century.

Considering the influence and power of the Commission, its choice of CE vision will impact the implementation of circularity policies well beyond its borders. By setting a *reformist circular society* discourse and *technocentric circular economy* policies, the EU is sending a key signal to remain a global leader in environmental policymaking, while doing little to seriously disrupt linear business models and practices within its borders.

This chapter fills an important research gap as there are still few studies on the EU's CE discourse and policies. The policy options and recommendations developed by this chapter can thus be relevant for both practitioners and academics seeking to better understand CE implementation. They might also be useful for the development of circularity policies at the member state and EU levels as well as outside the EU.

Moreover, this research tests the usefulness of the circularity discourse typology to open the imaginary on the CE and develop more inclusive and holistic pathways to sustainable, fair and resilient circular futures. By evidencing which visions are missing the discourse typology can help bring new ideas and perspectives to the table. This allows for better and more comprehensive policymaking, which tackles the systemic and long-term challenge of sustainability from a plural perspective.

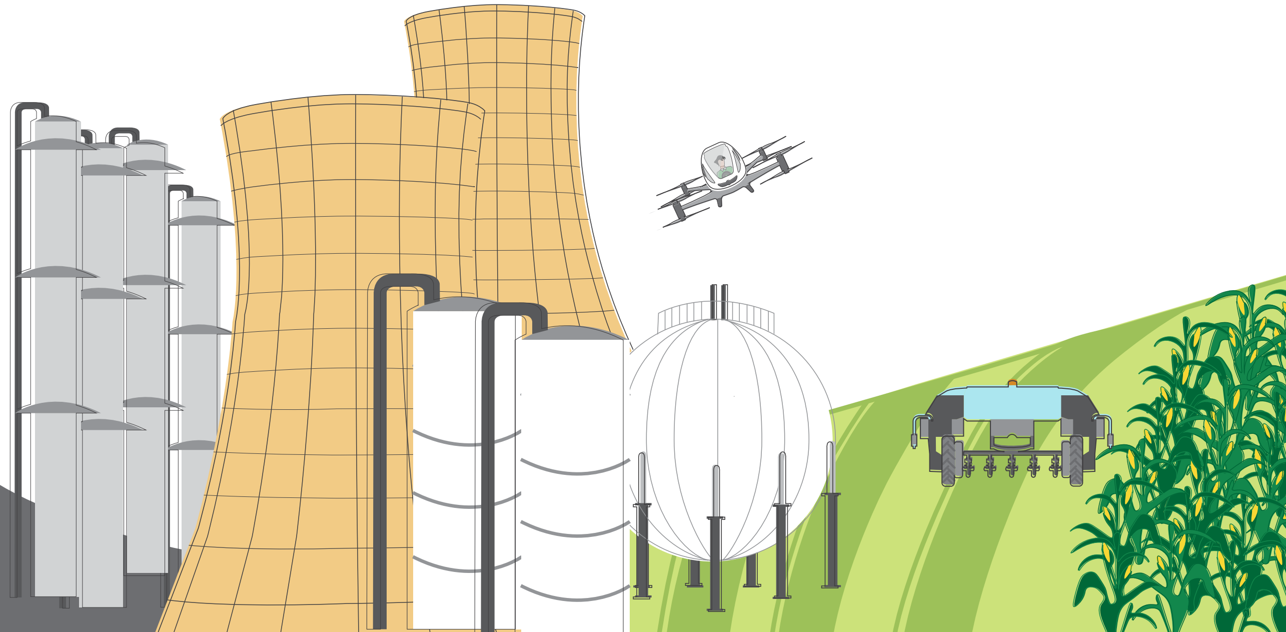
One of the core limitations of this research is that the state of implementation of the EU's CE policies has not been assessed, mainly because European CE policies are so recent that it is too early to measure their outcomes. Moreover, the political process of policy formulation was not analysed as it is beyond the scope of this chapter. The circularity discourse typology could provide a solid framework to analyse the EU's political decision-making process in order to understand what actors and discourses were included, and which ones were excluded and why. It can thus help understand whether the process was democratic, plural and deliberative. Moreover, this research focuses on the Junker Commission (2014-2019), a similar study would be valuable for the Von der Leyen Commission (2019-present) and its European Green Deal. Overall, further research on CE policy formulation and implementation is needed and, in doing so, the circularity discourse typology can be a useful methodological and conceptual tool.

Chapter 5

Transition to a Sustainable Circular Plastics Economy in The Netherlands: Discourse and Policy Analysis

This chapter is based on Calisto Friant, M., Lakerveld, D., Vermeulen, W. J., & Salomone, R. (2022). Transition to a Sustainable Circular Plastics Economy in The Netherlands: Discourse and Policy Analysis. Sustainability, 14(1), 190. https://doi.org/10.3390/su14010190

A previous version of this research was presented at the 26th International Sustainable Development Research Society (ISDRS) Conference in July 2020.



Abstract

The circular economy (CE) has become a key sustainability discourse in the last decade. The Netherlands seeks to become fully circular by 2050 and the EU has set ambitious circularity targets in its CE Action Plan of 2015. The plastics sector, in particular, has gained a lot of attention as it is a priority area of both the EU and Dutch CE policies. However, there has been little research on the different and often contested discourses, governance processes and policy mechanisms guiding the transition to a circular economy and society. This chapter aims to fill these gaps by asking what circular discourses and policies are being promoted in the Netherlands and what sustainability implications and recommendations can be drawn from it. It does so through a mix of media analysis, policy analysis, semi-structured interviews, and surveys using Q-methodology. Results indicate a dominance of technocentric imaginaries, and a general lack of discussion on holistic, and transformative visions, which integrate the full social, political, and ecological implications of a circular future. To address those challenges, this research brings key policy insights and recommendations which can help both academics and practitioners better understand and implement the transition towards a sustainable circular plastics economy.

5.1 Introduction

The unsustainable accumulation of plastic waste has often been described as one of the most pressing environmental challenges of our time (European Commission, 2018; UNEP, 2018). The global consumption of *synthetic polymers* (hereafter: plastics) has risen 20-fold since 1960, and is projected to keep rising by 3.8% per year (it will thereby triple from now to 2050) (UNEP, 2018; WEF et al., 2016). Yet, only about 9% of all plastic waste generated by humanity until 2015 has been recycled, the rest was either incinerated (12%) or ended up in landfills and the environment (79%) (Geyer et al., 2017). Nevertheless, it is undeniable that plastics provide key benefits to global economies as they are cheap, versatile, multifunctional and lightweight materials that often substitute the use of scarce resources and materials which often have higher environmental footprints (Bucknall, 2020). They also have valuable health and safety applications, such as protecting from biohazards, preventing food contamination, ensuring access to clean water and sanitation, and securing the hygiene of medical devices etc. (Klemeš et al., 2021) However, dealing with plastic waste sustainably and responsibly remains a monumental challenge. Plastic waste presents a significant threat to biodiversity as an incalculable number of animals die due to plastic ingestion or entanglement every year and many more are affected by the toxicity of plastic compounds and additives that leach into the environment (Azevedo-Santos et al., 2021; Law, 2017; Li et al., 2020; Xu et al., 2019). Plastics also present a risk to human health, with micro and nano-plastics now present virtually everywhere, including table salt (Karami et al., 2017), beer (Liebezeit and Liebezeit, 2014), honey and sugar (Liebezeit and Liebezeit, 2013), tap water (Kosuth et al., 2018) and even the air we breathe (Rist et al., 2018). Research has linked plastic production, use and pollution to various serious diseases including cancer (Brophy et al., 2012; DeMatteo et al., 2013; Y.-L. Wang et al., 2020), endocrine system disorders (Andra and Makris, 2012; Brophy et al., 2012; Darbre, 2020), reproductive hazards (DeMatteo et al., 2013; Manikkam et al., 2013; Yin et al., 2021) and obesity, diabetes and cardiovascular diseases (Biemann et al., 2021; Manikkam et al., 2013; Nadal, 2013). Moreover, producing, transporting, and recycling plastics produces significant amounts of greenhouse gases, thereby exacerbating global warming (Vollmer et al., 2020).

The circular economy (CE) is often promoted as a solution to these problems as it could allow for the elimination of plastic waste through innovative recovery processes, bio-based alternatives and reuse and reduce solutions. Various initiatives have thus been created to foster a CE transition for the plastic sector such as the 'Global Commitment' lead by the Ellen MacArthur Foundation (Ellen MacArthur Foundation, 2021), the 'European Plastic Pact' initiated by France, the Netherlands and Denmark (European Plastics Pact, 2021) and the 'Circular Plastics Alliance' established by the European Commission (European Commission, 2021).

The Dutch government, in particular, has set the ambitious target to become 100% circular by 2050 and its Circular Economy Action Plan focuses on plastics as a strategic sector to lead the transition (Government of Netherlands, 2016). Despite having a strong plastic waste management system with high recovery figures (with a 99% combined recycling and incineration rate for plastic packaging), the Netherlands is still facing key challenges. Indeed, Dutch plastic consumption continues to rise, and a proportion of its plastic waste is leaked to third countries and ends up in the environment (Bishop et al., 2020; Brooks et al., 2018). Moreover, nearly 50% of end-of-life plastics in the Netherlands are incinerated instead of recycled (Brouwer et al., 2019).

The transition to a CE for plastics in the Netherlands, therefore, remains a significant challenge. Yet, there has been very limited research on the topic as there are just over a dozen academic papers on the CE of plastics in the Netherlands[41]. Previous research on the topic has focused on analysing bio-plastic alternatives (Blok et al., 2019; Bluemink et al., 2016; van Leeuwen et al., 2018), consumer habits (Núñez-Cacho et al., 2020) and polymer recycling practices and innovations (Brouwer et al., 2018; Cramer, 2018; Demacsek et al., 2019; Leslie et al., 2016; McCarville, 2019; Picuno et al., 2021; Stevels and Smit, 2019). However, studies have not analysed the policies and discourses of the CE transition for the plastic sector in the Netherlands. Yet this is a key question as the CE is a contested and diverse concept that can lead the CE transition in many different directions, with different socio-ecological implications, depending on the specific discourse and vision of circularity which is implemented (Calisto Friant et al., 2020; Genovese and Pansera, 2020; Korhonen et al., 2018b; Lazarevic and Valve, 2017). This chapter, therefore, addresses this key research gap by answering the following research question:

> *What are the main discourses in the transition towards a sustainable circular plastics economy in the Netherlands and what implications and recommendations can be drawn from it?*

To answer this question this research conducts a policy, media, and stakeholder analysis as well as 24 semi-structured expert interviews, and a survey and statistical factor analysis with Q-methodology. After presenting the methods, and results, this chapter discusses the significance of these findings and brings key policy recommendations which can help both academics and practitioners better understand and implement a sustainable circular plastics economy.

5.2 Methodology

This research uses a single case study approach using Q-methodology to provide an in-depth understanding of the different discourses and policies in the transition towards a sustainable circular plastics economy in the Netherlands.

Q-methodology is an interdisciplinary holistic mixed (quantitative and qualitative) research method, which was first introduced by Stephenson in 1935 (Barry and Proops, 1999). The

41 Based on a Scopus search for "circular economy" AND netherlands AND plastic* OR polymer* (Title, Abstract, Keywords) conducted on the 19th of July 2021, finding a total of 13 results.

purpose of a Q study is to identify and represent different perspectives regarding a particular topic (Brown, 1980; Watts and Stenner, 2005). It is a commonly used method for discourse analysis as it identifies how different societal groups align with certain viewpoints, ideas, and beliefs (Curry et al., 2013; Stevenson, 2015).

Q-methodology can also be applied to elicit alternative policies and solutions to address a particular topic or issue (Zabala et al., 2018). For instance, Stevenson (2015) used Q-methodology to identify the underpinning green political economy discourses and solutions (Stevenson, 2015); Ellis et al. (2007) used it to investigate the acceptability of different wind farm proposals (Ellis et al., 2007); Gall and Rodwell, (2016) used it to evaluate the social acceptability of marine protected areas (Gall and Rodwell, 2016); and Curry et al., (2013) used it to analyse environmental and resource dimensions of sustainability policies (Curry et al., 2013). It is thus particularly well suited to the present research question, as it allows us to clearly and systematically identify different societal discourses in the transition towards a sustainable circular plastics economy in the Netherlands as well as to evaluate different policy options and assess their acceptability amongst different societal groups.

This research followed a 5 stage Q-methodology process, adapted from Webler et al. (2009) (see Figure 5.1) (Webler et al., 2009). First, we establish the conceptual framework which provides us with the conceptual lens with which to better understand and analyse the diverse discourses surrounding the transition to a sustainable circular plastics economy in the Netherlands. Second, we define the concourse on the topic, which means mapping the wide variety of stakeholder perspectives and viewpoints on the study object (Brown, 1980). This is done through a mix of media and stakeholder analysis, policy analysis and semi-structured interviews. A set of representative statements on the topic, called the Q-sample, are then derived from the concourse (Zabala et al., 2018)(stage 3). In a fourth stage, respondents (the Participant set or P-set) are asked to answer a survey where they rank the chosen set of statements (Q-sample) based on individual viewpoint and preference. This process is called 'Q-sorting' and it is a key part of the Q-methodology as this is how the participant's underlying discursive position on the studied topic is revealed (Brown, 1993). The Q-sorting process is followed by factor analysis that evidences groups of respondents who sorted the set of statements (Q-sample) similarly (stage 5). These groups of similar responses are combined into 'factors', which reflect a district discourse on the studied topic.

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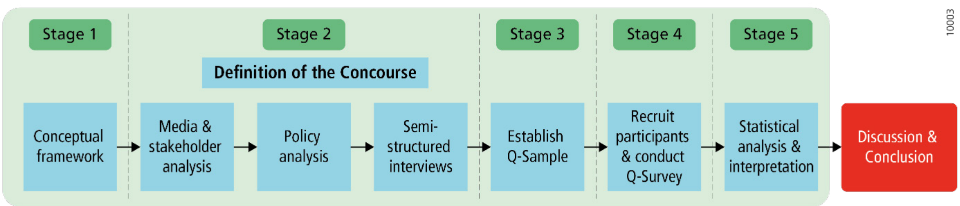

FIGURE 5.1 | Research method and process.

5.2.1 Stage 1: Conceptual framework

5.2.1.1 Circularity discourses

The CE has become a key sustainability discourse in the last 10 years. It is now a major component of many environmental policies in various industries and countries, especially in China where the concept has been part of national policy since 2002 (Qi et al., 2016) and in the EU, which adopted a comprehensive CE "Action Plan" in 2015 (McDowall et al., 2017).

However the origins of the concept date back much further to ideas such as the Economy of Permanence (Kumarappa, 1945), The Limits to Growth (D. Meadows et al., 1972), Industrial Ecology (Frosch and Gallopoulos, 1989), Steady-State Economics (Daly, 1977), Ecological Design (Papanek, 1972) etc. The CE is thus best understood as an umbrella concept, which encompasses a plurality of different visions and ideas, all of which seek to establish sustainable resource and energy cycles so humanity can live in harmony with the biophysical limits of the Earth (Calisto Friant et al., 2020). Nevertheless, the CE is still an "essentially contested concept" in the public and academic debate with many actors proposing different CE visions based on their economic and political interests (Korhonen et al., 2018b).

To better navigate and understand these differences, this research uses the discourse typology developed by Calisto-Friant et al. (2020), which has also been used to analyse the EU's CE policies (Calisto Friant et al., 2021), CE discourses in Norway (Hermann and Pansera, 2020; Ortega Alvarado et al., 2021), the European plastics strategy (Palm et al., 2021) and competing CE discourses in Australia (Melles, 2021).

The abovementioned typology divides circularity discourses based on two main criteria (see Figure 5.2). First, whether discourses have a *holistic* approach by including the social justice and political empowerment dimensions of circularity or a *segmented* approach by focusing only on technical and economic means to eco-efficiency. Second, whether discourses are *optimist* or *sceptical* regarding the possibility of decoupling environmental degradation from economic growth (eco-economic decoupling). Different combinations of the above criteria lead to 4 main circularity discourse types[42]:

Reformist Circular Society (*optimist* and *holistic*) discourses seek to create a sustainable circular future through a combination of innovative business models, social policies and technological breakthroughs (such as Cradle to Cradle (McDonough and Braungart, 2002), the Blue Economy (Pauli, 2010) and Natural Capitalism (Hawken et al., 1999)).

Technocentric Circular Economy (*optimist* and *segmented*) seek to reconcile economic development with ecological sustainability through innovative business models and technological breakthroughs, especially in resource recovery, biotechnology and renewable

42 More information of each discourse is available in the following article: A Typology of Circular Economy Discourses: Navigating the Diverse Visions of a Contested Paradigm, (2020) *Resources Conservation & Recycling*, https://doi.org/10.1016/j.resconrec.2020.104917

energy (such as Bioeconomy(OECD, 2004), Reverse Logistics (Rogers and Tibben-Lembke, 1998), and Industrial Metabolism(Ayres and Simonis, 1994)).

Transformational Circular Society (*sceptical* and *holistic*) discourses seek to create a fair, democratic, de-colonial and sustainable post-capitalist future where humanity and nature live in mutual harmony by re-localizing and redistributing power, wealth and knowledge (such as degrowth (Latouche, 2009), buen vivir (Gudynas and Acosta, 2011) and steady-state economics (Daly, 1977)).

Fortress Circular Economy (*sceptical* and *segmented*) seek to ensure biophysical stability and geostrategic resource security, through technological innovations and top-down controls on population and economic shortages (such as the Tragedy of the Commons (Hardin, 1968), The Population Bomb (Ehrlich, 1968), and Catton's Overshoot (Catton, 1980)).

		Approach to social, economic, environmental and governance considerations 10003	
		Holistic	**Segmented**
Technological innovation and ecological collapse	**Optimist**	**Reformist Circular Society** - **Assumptions**: eco-economic decoupling is possible and social justice and democracy is key for a circularity transition. - **Goal**: human prosperity and well-being within the biophysical boundaries of the earth. - **Means**: Technological breakthroughs and social policies that benefit humanity and natural ecosystems. - **Example concepts**: Natural Capitalism, Cradle to Cradle, The Performance Economy, The Natural Step, The Blue Economy, Eco-system economy, Regenerative Design. - **Proponents**: international organizations, large foundati-ons and some governments.	**Technocentric Circular Economy** - **Assumptions**: eco-economic decoupling is possible and social justice and democracy is not key for a circularity transition. - **Goal**: economic prosperity and development without negative environmental externalities. - **Means**: economic innovations, new business models and unprecedented breakthroughs in CE technologies - **Example concepts**: Industrial Ecology, Reverse Logistics, Biomimicry, Industrial Symbiosis, Cleaner Production, Bioeconomy. - **Proponents**: corporations, some national and city governments, and international organizations.
	Sceptical	**Transformational Circular Society** - **Assumptions**: eco-economic decoupling is impossible and social justice and democracy is key for a circularity transition. - **Goals**: A world of conviviality and frugal abundance for all, while fairly distributing the biophysical resources of the earth - **Means**: Complete reconfiguration of the current socio-poli-tical system and a shift away from productivist and anthropocentric worldviews. - **Example concepts**: Conviviality, Steady-state economics, Permacircular Economy, Degrowth, Social Ecology, Buddhist Economics, Buen Vivir, Ubuntu. - **Proponents**: social movements, bottom-up circular initiatives, and indigenous movements.	**Fortress Circular Economy** - **Assumptions**: eco-economic decoupling is impossible and social justice and democracy is not key for a circularity transition. - **Goal**: maintain geostrategic resource security in global conditions where widespread resource scarcity and human overpopulation cannot provide for all. - **Means**: innovative technologies and business models combined with rationalized resource use and migration and population controls. - **Example concepts**: The tragedy of the Commons, The Population Bomb, Overshoot, Disaster Capitalism, Capitalist Catastrophism. - **Proponents**: Geostrategic think tanks and state policies.

FIGURE 5.2 | Circularity discourse typology (adapted from Calisto Friant, et al., 2020).

5.2.1.2 Plastics and circularity

Future trends show that the production of virgin plastics will increase at a faster pace than the development and deployment of related after-use systems and infrastructure(UNEP, 2018; WEF et al., 2016). Therefore, strong CE actions are required to reverse this trend on both the demand side (through refuse, reduce, reuse, and replace strategies) and the supply side (through better plastic waste collection and recovery systems). Each of these actions has a multitude of social, economic and environmental implications, which remain poorly researched and understood (Barrowclough and Birkbeck, 2020).

Choices between different recovery strategies or plastic alternatives involve complex trade-offs between economic considerations and ecological imperatives. Moreover, social components are essential, as a sustainable circular plastics economy will inevitably necessitate behavioural change (reduced consumption, better sorting, switch to re-usable packaging etc.) and will lead to unavoidable costs and benefits, which must be equitably distributed within society (through progressive taxation and social policies) (Barrowclough and Birkbeck, 2020).

Moreover, recovery systems in Global North are currently dependent on the export of plastic waste to the Global South (Brooks et al., 2018). However, the impact of indiscriminate export of end-of-life plastics to the Global South poses key social and environmental justice concerns. Indeed, waste is often exported to countries where working conditions and environmental standards are relatively low, and which have limited administrative and technological capacity to control mismanaged waste (Barnes, 2019; Bishop et al., 2020). This not only increases the amount of plastic that ends up polluting natural ecosystems, but also exacerbates human health problems related to unsafe recovery systems. The ban that China placed on the import of most plastic waste in 2018 has brought light to this issue (Brooks et al., 2018). This also led to the 2019 Norwegian Amendment to the Basil Convention on the export of hazardous waste, which aims to increase the regulation and transparency of the international trade of plastic waste (Barrowclough and Birkbeck, 2020). The above trends have created a renewed momentum for countries in Global North to transition towards a sustainable circular plastics economy (Syberg et al., 2021).

To operationalize this objective and create a CE for plastics, there are many interrelated actions and strategies that countries may use. These can be categorized through the 10R hierarchy of CE "action imperatives" developed by Reike et al. (2018) (see Table 5.1 below). This 10R framework not only helps visualize the range of policy options for the transition to a sustainable circular plastics economy, but it also helps reveal stakeholder discourses on CE. Indeed, the research of Calisto Friant et al. shows that different circularity discourses focus on a different set of Rs: *Technocentric Circular Economy* is associated with R4-R9 as it is mostly concerned with industrial and recycling solutions, a *Reformist Circular Economy* with R2-R7 as it is highly focused on innovative service-based business models and sharing economies, a *Transformational Circular Society* with R0-R6 as it seeks to build social and solidarity economies focused on sufficiency and autonomy, and a *Fortress Circular Economy* with R1-R9 as it pragmatically engages with all value retention options from a top-down perspective (Calisto Friant et al., 2020).

In addition to the above value retention hierarchy, it is important to differentiate bio-based, biodegradable and fossil-based plastics. Bio-based plastics are polymers made from natural organic matter such as corn, wood, and palm oil (Bucknall, 2020). Not all bio-based plastics are biodegradable but many of them are. Those which are biodegradable, however, often only effectively biodegrade in industrial composting facilities (Mah, 2021). Depending on the type of biomaterial used, the carbon footprint of bio-based plastics can be anywhere from 85% lower to 50% higher than that of fossil-based plastics (Simon, 2019). However, bio-based plastics compete for limited land resources with biodiversity conservation, food production and renewable energy generation (Verrips et al., 2019). They can therefore increase food insecurity and intensify the collapse of biodiversity (Stafford and Jones, 2019). While only about 1% of plastics in the world are bio-based, they can pose significant problems to recovery systems, which are currently not designed to recycle or compost them (Verrips et al., 2019).

TABLE 5.1 | 10R framework applied to plastics.

R's	Value Retention Options
R0	**Refuse:** buying and consuming less plastics products and packaging and replacing the use of plastic materials and packaging during product design.
R1	**Reduce:** reducing plastic usage, by using less plastic material by unit of output and improving recyclability by using only one type of plastic and avoiding harmful chemical additives.
R2	**Resell/Reuse:** reusing packaging through reusable containers, deposit-return systems and bulk buying etc. and re-using products through sharing platforms and second-hand markets.
R3	**Repair:** extending the lifetime of a plastic product by repairing components when broken rather than discarding them, this can be done directly by producers through guarantee systems or by citizens themselves through repair networks, communities and services.
R4	**Refurbish:** improving and upgrading certain components of a product or building, to extend its life and enhance its quality and value (common for computers, hotels, offices, aeroplanes, and trains). Sometimes called reconditioning or retrofitting).
R5	**Remanufacture:** using various parts and components of a discarded product in a new product with the same function, thereby extending the life of its plastic components.
R6	**Repurpose:** reusing discarded goods for another function thereby giving them a new life (e.g. plastic sheetings become handbags, plastic bags become art installations, plastic bottles become lamps etc.). Sometimes called upcycling.
R7	**Recycling:** obtaining secondary raw materials from a post-consumer product. For plastics, this can be done through mechanical, or chemical processes.
R8	**Energy recovery:** recovering energy through incineration or anaerobic digestion (for biodegradable plastics).
R9	**Re-mine:** retrieving waste plastics by landfill mining.

Source: adapted from Reike, et al. 2018

Concerning recycling (R7), it is important to distinguish chemical from mechanical recycling options. In mechanical recycling, plastics are converted into secondary raw material through sorting, washing, grinding and regranulation processes (Ragaert et al., 2017). Mechanical recycling is not perfectly efficient as a significant portion of plastics are lost in the process (10-30% depending on the technology) (Picuno et al., 2021). Moreover, the resulting

5

plastics are of lower quality than virgin materials as plastic compounds are degraded and contaminated by the recycling process (Vollmer et al., 2020). Most mechanically recycled plastics are therefore not considered food-grade material and can only be used in lower-value applications such as shampoo bottles, flower pots and paint buckets (Picuno et al., 2021). It is nonetheless the most widespread form of recycling as it is economically viable for many different plastic types such as polyethylene terephthalate (PET), polypropylene (PP), and polyethylene (PE) (Gradus, 2020).

Chemical recycling processes are relatively recent innovations by which large plastic polymers can be broken down into smaller oligomers and monomers, that can be used as building blocks for virgin plastics. This type of recycling is carried out through techniques such as methanolysis, hydrolysis, solvolysis, glycolysis, and pyrolysis (Ragaert et al., 2017). It typically involves heating polymers to high temperatures with different catalysts, such as water or methanol(Vollmer et al., 2020). Chemical recycling can lead to higher-quality and higher-value outputs than mechanical recycling yet, it is more energy-intensive than chemical recycling and has yet to become economically viable on a large scale (Bucknall, 2020; Mah, 2021; Vollmer et al., 2020).

Overall, whether through mechanical or chemical processes, plastic recycling is complex and has many physical limitations. In addition to the abovementioned challenges, the presence of many different types of plastics in the same product (electronics can contain over 14 different polymers) and the widespread use of additives (which are often toxic such as brominated flame retardants) heavily complicates their recovery (Gradus et al., 2017; Leslie et al., 2016; Ragaert et al., 2017). The heavy contamination of waste streams from post-consumer plastic also greatly complicates the recovery process (Gradus, 2020; Simon, 2019; Vollmer et al., 2020). Recycling is thus never 100% efficient and higher value retention options are therefore preferred from a sustainability standpoint as they increase the lifespan of plastic products (R2-R6) or reduce the need to produce plastics in the first place (R0-R2). In fact, research has found that re-usable packaging, such as returnable bottles, has significantly lower ecological footprints than single-use plastics (Boesen et al., 2019; Coelho et al., 2020; Greenwood et al., 2021).

The above review of the diversity of CE discourses and the key value-retention options for plastics allows us to better understand the complexity of the topic. It thereby provides a solid conceptual basis for the analysis of the discourses and policies regarding the transition to a sustainable circular plastics economy in the Netherlands (sections 5.3) as well as to develop relevant recommendations based on our findings (section 5.4).

5.2.2 Stage 2: Definition of the Concourse

In this step, all different positions and discourses are identified by gathering relevant opinions, ideas, beliefs, and assumptions surrounding the study object. A mixture of media (newspaper) analysis, stakeholder analysis, policy analysis and semi-structured expert interviews were conducted to define the concourse. While analysing the concourse, we uncovered that the overweighing majority of plastic waste in the Netherlands and the EU emanates from packaging, this research will thus focus on the abovementioned sector (PlasticEurope, 2020).

5.2.2.1 Media & Stakeholder Analysis

The LexisNexis database was used to gather Dutch newspaper articles on circular economy and plastics. Using "plastic*" OR "kunststof*" AND "circulaire economie" OR "kringloopeconomie" as keywords, led to 1212 newspaper articles published between 01-01-2010 and 17-12-2019. This sample was reduced to 183 news articles by selecting the 8 national paid newspapers (Trouw, Financieele Dagblad, Nederlands Dagblad, NRC Handelsblad, Volkskrant, Telegraaf, Reformatorisch Dagblad, and Algemeen Dagblad). All articles that did not specifically talk about plastic policies or plastic waste management were excluded, leading to a final selection of 42 articles (see supplementary materials A of Calisto Friant et *al.* (2022a) for the full list of newspaper articles).

These 42 news articles were carefully reviewed and coded with Discourse Network Analyzer 2.0 to identify and categorise the organizations and actors they mentioned or quoted. This method of stakeholder analysis is similar to the one used by Lazarevic and Valve (2017) who identified actors engaging in the CE debate at the European level by reviewing articles in the EurActiv and ENDS Europe news services. In addition to this, we identified organizations from the Dutch Plastic Pact (Plastic Pact NL, 2021) and The National Agreement on the CE (Government of Netherlands, 2017), two government initiatives aimed at promoting the CE through multi-stakeholder agreements. This led to the identification of 211 organizations which were divided into 7 broad actor groups (see Figure 5.3 and supplementary materials B of Calisto Friant et *al.* (2022a) for the full list of identified stakeholders).

5.2.2.2 Policy Analysis

The authors reviewed 23 policies related to the transition to a sustainable circular plastics economy from the EU, the Dutch government, and the producer responsibility organization (Afvalfonds Verpakkingen) which represents all plastic packaging producers and importers in the Netherlands to comply with the compulsory extended producer responsibility legislation (see Table 5.2). Policies were analysed qualitatively to understand the CE legislative framework and transition pathway for plastics in the Netherlands.

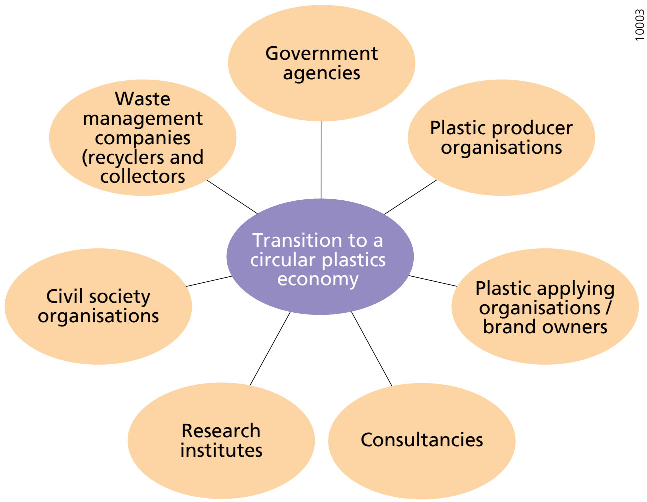

FIGURE 5.3 | Stakeholder groups involved in the transition to a circular plastics economy.

TABLE 5.2 | List of Analysed policy documents.

Year	Organization	Dutch document name	English document name
2003	Dutch Government	Landelijk Afvalbeheerplan 1	National Waste Management Plan 1
2007	Dutch Government	Landelijk Afvalbeheerplan 1	National Waste Management Plan 1 (2007 amendment)
2007	Dutch Government	Besluit Beheer Verpakkingen en papier en karton	Packaging and Paper and Cardboard Management Decree
2007	Dutch Government	Raamovereenkomst Verpakkingen en zwerfafval	Framework Agreement on Packaging and litter
2013	Dutch Government	Programma: Van afval naar grondstof	Program: From waste to raw material
2014	Dutch Government	Raamovereenkomst Verpakkingen	Framework Agreement on Packaging
2014	Afvalfonds Verpakkingen	Monitoringsrapportage 2014	Monitoring report 2014
2014	Dutch Government	Landelijk Afvalbeheerplan 2	National Waste Management Plan 2
2014	Dutch Government	Besluit Beheer Verpakkingen	Packaging Management Decree
2015	Afvalfonds Verpakkingen	Monitoringsrapportage 2015	Monitoring report 2015
2016	Dutch Government	Rijksbrede programma Nederland Circulair in 2050	A circular economy in the Netherlands by 2050
2016	Afvalfonds Verpakkingen	Monitoringsrapportage 2016	Monitoring report 2016
2017	Dutch Government	Grondstoffenakkoord	National agreement on the circular economy
2017	Dutch Government	Transitie agenda Kunststoffen	Transition agenda circular economy for plastics
2017	Afvalfonds Verpakkingen	Monitoringsrapportage 2017	Monitoring report 2017
2018	European Commission		A European Union Strategy for plastics in a Circular Economy 2018

Year	Organization	Dutch document name	English document name
2018	European Commission		Directive 2018/851 on waste
2018	European Commission		Directive 2018/852 on packaging and packaging waste
2018	Afvalfonds Verpakkingen	Monitoringsrapportage 2018	Monitoring report 2018
2019	Afvalfonds Verpakkingen	Monitoringsrapportage 2019	Monitoring report 2019
2019	European Commission		Directive 2019/904 on the reduction of the impact of certain plastic products on the environment
2019	Dutch Government	Plastic Pact NL	Plastic Pact NL
2019	Dutch Government	Landelijk Afvalbeheerplan`3	National Waste Management Plan 3

5.2.2.3 Semi-Structured Expert Interviews

Semi-structured interviews with professionals in the Dutch plastics sector were held to explore their perspectives on the transition to a sustainable circular plastics economy in the Netherlands. Interviewees were derived from the results of the stakeholder analysis as well as through 'snowball-sampling'[43]. The general objectives of the interviews were to identify stakeholder opinions regarding the transition towards a sustainable CE for plastics in the Netherlands, including their perspective on current public policies, business practices, technologies, environmental issues and social implications (see supplementary materials C of Calisto Friant et *al.* (2022a) with full interview questions). Interviews were conducted online between March and April 2020. In total, 74 organisations were approached for an interview of which 24 accepted the interview request (35.4% response-rate). To ensure diversity and plurality of views and perspectives, interviews were sought with actors from all 7 stakeholder groups (see Figure 5.4 and supplementary materials D of Calisto Friant et *al.* (2022a) for further information on each interviewee).

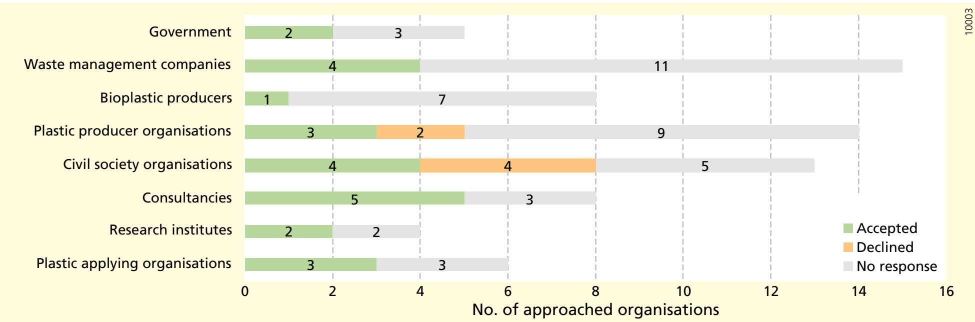

FIGURE 5.4 | Overview of interviews in each stakeholder group.

43 The Snowball-sampling method used in this study consisted in asking each interviewee to suggest other participants based on their knowledge, expertise, and network in the field (Webler et al., 2009). Initial interviewees were selected by contacting organizations found through the stakeholder analysis, with a key focus to ensure diversity by approaching actors in each of the 7 identified actor groups.

5.2.3 Stage 3: Establish Q-Sample

The Q-sample is the set of statements used as input for the Q-Survey. The Q-Sample is obtained from the analysis of the concourse and must reflect the wide variety of opinions and perspectives on the topic. In this research, each statement was formulated directly by the authors following a careful investigation of the concourse and the diversity of different actions and strategies that interviewees, policy documents and newspaper articles advocated on the topic. Diversity was sought by incorporating a wide number of opposing and often conflicting policy alternatives. Consistency was ensured by formulating each statement as a direct policy action to be carried out by one or more clearly identified actor. A first set of 51 statements was established which was then refined by combining and regrouping similar or closely related points. A final set of 42 statements was thereby developed for this research (see Table 5.3). This number is consistent with Q-Method guidelines, which suggest that a Q-Sample should have anywhere between 40 and 80 statements (Watts and Stenner, 2005). After the final Q-sample was established, the survey was reviewed by 4 researchers from our institution to ensure clarity and refine any ambiguities or potentially confusing statements. Ease of use was also sought by pilot testing the final Q-sample in several online Q-method survey platforms. This led to the choice of "Q-Methods Software" as the most user-friendly platform for this Q-Survey.

TABLE 5.3 | Q statements for the transition to a sustainable circular plastics economy in the Netherlands (Q-Sample).

#	Themes	Q statements
#1	Alternatives to plastic	The government and companies should investigate and promote sustainable alternative materials to plastic.
#2	Ban export outside the EU	The EU should ban the export of plastic waste outside Europe so plastic waste is recycled and processed within European borders.
#3	Benefits of plastics	The media should communicate the health and environmental benefits of plastics better, especially compared to alternatives, which can have a higher environmental footprint.
#4	Promote bio-based plastics	The government and companies should encourage and highly increase the use of bio-based plastics.
#5	Regulate bio-based plastics	The government should highly regulate bio-based plastic to prevent that they compete with food production and biodiversity conservation.
#6	Clean-up fund	The government and companies from the Global North should establish a fund to finance clean-up activities of plastics in the oceans and other natural ecosystems.
#7	Promote compostable plastics	The government and companies should promote the use of compostable plastics for applications where it is suitable (e.g. tea bags, coffee capsules, cups, cutlery etc.).
#8	Consumer responsibility	Consumers should be responsible for the pollution of plastics in the environment, not only companies.
#9	Ban controversial fossil plastics	The government should ban plastics made from controversial sources such as tar sands and shale gas.

#	Themes	Q statements
#10	Deposit return system	The government should mandate the establishment of a deposit return systems for all relevant plastics (not just large PET bottles).
#11	Design for sustainability	Companies should always design for recyclability and lower overall environmental impacts throughout a product's lifecycle (including resource use and hazardous substances).
#12	Discourage incineration	The government should establish financial and legal incentives to discourage the incineration of lower grade plastics (with or without energy recovery) and promote their recycling.
#13	Education & awareness	All stakeholders should educate citizens and create more public awareness and change the culture of mass consumption to reduce overall plastic use.
#14	Enforcement and control	The government and companies should enforce stronger control policies to prevent mismanaged plastics (illegal dumping and exports to the Global South).
#15	Expand EPR to other plastics	The government should expand EPR systems to other plastics currently not covered by EPR schemes.
#16	Fair and just societal system	The government should establish a fair and just societal system to make sure that all the fees and costs of a circular economy transition for plastics do not fall on the poorest and most vulnerable people.
#17	Global solidarity	Government and companies from the Global North should provide financial assistance and technology transfers to countries in the Global South so they can better manage plastic waste, as that is where most ocean plastics come from.
#18	Health, safety and toxicity	Regulatory agencies should strengthen and improve the enforcement of health, safety, and hazardous substances standards (OHS and REACH) on plastic products, and their production process.
#19	EPR inclusiveness and participation	Afvalfonds Verpakkingen should include civil society organisations and local and national government representatives in a participatory and inclusive manner so that its decisions regarding plastics are more democratic and collaborative.
#20	Increase EPR fees	Afvalfonds Verpakkingen should increase the waste management contribution fee paid to the EPR system because the current price is too low to foster the best recovery practices.
#21	Innovation fund	The government should establish a fund focused on innovation and R&D of circular solutions (such as new sorting and recycling technologies) financed by fees on virgin materials.
#22	Marketing on recyclability	The government and companies should ensure that claims about recyclability and composability are not misleading and deceptive.
#23	Municipal autonomy	Municipalities should have more autonomy in the management of their recycling systems so that small-scale plastic recovery initiatives can be created and develop disruptive innovations.
#24	Ban non-recyclable plastics	The government should ban non-recyclable single-use plastic applications until an effective collecting, sorting, and recycling infrastructure is implemented.
#25	Open-source innovations	The government, companies, and civil society organisations should promote open source technologies for plastic collection, sorting, and recycling to expand innovations throughout society.
#26	Multi-stakeholder participation and collaboration	The government should increase civil society participation and multi-stakeholder cooperation along the entire value chain to improve plastic policies and practices including eco-design, reuse, and recyclability.

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#	Themes	Q statements
#27	Material passport	The government and companies should ensure that all plastic products and packaging have a material passport with the full list of materials and their origin (including all the different polymers and additives) so recyclers know how to process them.
#28	Restrict polymer types	The government should restrict the types of polymers and additives allowed in the market so there are only a handful of plastic streams that can be easily sorted and recycled.
#29	Product ecological footprint	The government and companies should ensure that all products contain a health, environment, and social footprint label (which includes information about the packaging), so consumers have full information to make sustainable choices.
#30	Recycled content requirements	The government should set high minimum requirements for recycled plastic content in new plastic products.
#31	Recycling bins	The government should provide more recycling bins and containers to people living in large cities, so they don't have to walk large distances to be able to recycle.
#32	Recycling targets	The government should increase plastic recycling targets.
#33	Less regulatory constraints	The government should place less regulatory constraints for bio-based, biodegradable, and recycled plastics, especially for food-uses.
#34	Renewable energy sources	Companies should strive to use less energy as well as use only renewable energy sources to produce, transport, and recycle plastics.
#35	Restrict sales in Global South	Companies should not sell non-biodegradable single-use plastic products in countries where the waste system cannot deal with plastic waste (such as in many countries in the Global South).
#36	Promote reusable packaging	The government and companies should highly increase the use of reusable packaging.
#37	Short loops	Companies should keep plastic loops short and minimise transport costs by using local products and materials as well as local sorting, recycling, and production facilities.
#38	Employment and social inclusion	The government should help people working in unsustainable sectors of the plastic industry to re-locate to the circular plastic economy and especially help the employment of people with poor job prospects.
#39	Taxes on plastic	The government should tax virgin fossil-based plastics and non-recyclable plastics and reduce the taxes on recycled plastics.
#40	Transparency on pledged commitments	Companies should publicly disclose data on their use of plastics including information on plastic recycling and bioplastics, as well as data regarding the progress on the achievement of pledged commitments such as the Plastic Pact.
#41	Unified municipal system	The government should establish a single system for waste management in all municipalities to generate efficient economies of scale for plastic recovery operations.
#42	Reduce virgin-plastic consumption	The government should place targets to reduce overall plastic consumption per capita.

Source: developed by authors from the analysis of the concourse.

5.2.4 Stage 4: Recruit participants (P-Set) and conduct Q-Survey

The P-set defines the participants which respond to the Q-survey. The selection of the P-set is not carried out through a random process but is rather a carefully selected sample of participants who are actively involved in the researched topic (Brown, 1980). A successful Q-study necessitates anywhere from 15 to 60 participants (Gall and Rodwell, 2016). Moreover, there should always be fewer participants than Q-statements (Stevenson, 2015). What matters more than participant numbers is diversity and plurality in participant perspectives (Webler et al., 2009). To ensure this diversity 145 participants were invited from all 7 stakeholder groups identified in stage 1. In total, 26 participants answered the Q survey (17.8% response rate), and each stakeholder group had at least 2 respondents, thereby ensuring the plurality and diversity of views needed for a Q-study (see Figure 5.5).

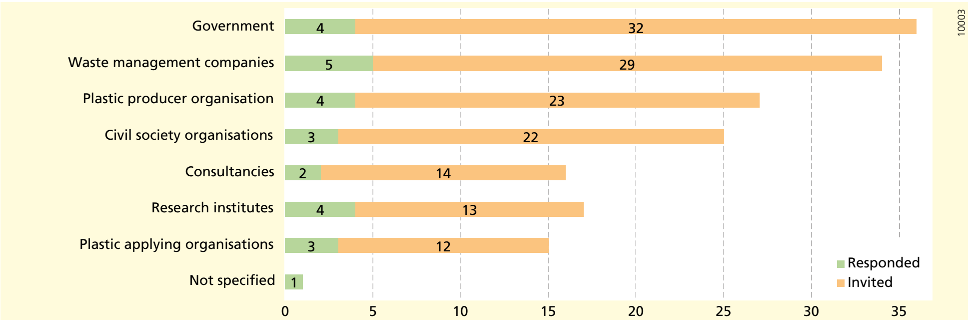

FIGURE 5.5 | Invitations and responses to the Q survey per stakeholder group.

During the Q-survey participants were asked to rank all the 42 statements (Q-sample) following this leading question: "How important do you consider the following action statements in the transition to a sustainable circular plastics economy in the Netherlands?". To do so, participants had to place the statements on an 11-point quasi-normal distribution ranging from "least important (-5)" to "neutral (0)" to "most important (+5)" (see Figure 5.6). The nature of the quasi-normal distribution pyramid forced participants to make important trade-offs between statements they considered similarly important or unimportant and, in doing so, participants revealed their underlying opinions and points of view on the topic. Each participant's final set of submitted ranked statements constitutes his or her "Q-sort" (the full Q-survey process and instructions can be seen in supplementary materials E of Calisto Friant et *al.* (2022a)).

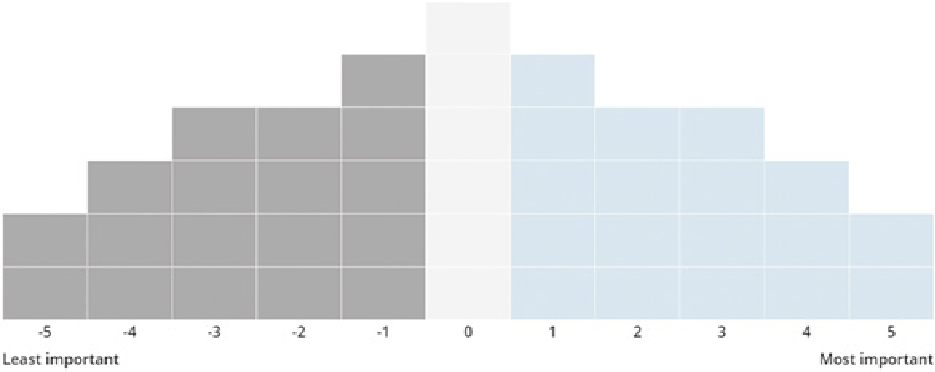

FIGURE 5.6 | The ranking grid of the Q-sort process.

5.2.5 Stage 5: Statistical analysis and interpretation

The completed Q-sorts from all respondents constitute the main input for the factor analysis. PQMethod software was used to analyse the data. This (free) software is specifically developed for Q factor analysis and is widely used and recognised by researchers in the field (Curry et al., 2013; Gram-Hanssen, 2019; Watts and Stenner, 2005; Webler et al., 2009; Zabala et al., 2018). The factor analysis groups participants with similar Q-sorts into groups, which reveal their common perspectives on the topic (Watts and Stenner, 2005; Webler et al., 2009). Q-survey results were processed using the Centroid method and Varimax rotation, which are widely used statistical tools to systematically uncover different participant discourses through Q-methods (Barry and Proops, 1999; Stevenson, 2015; Watts and Stenner, 2005; Webler et al., 2009).

The results of the factor analysis results were carefully examined and interpreted by contrasting the perspective of each factor group with the typology of circularity discourses developed by Calisto Friant et al. (2020). This allowed the mapping of the different factor positions in the wider literature on the transition to a circular economy and society.

5.3 Results

Results are divided into 3 sub-sections. Section 5.3.1 summarises the relevant policies and practices surrounding the transition towards a sustainable circular plastics economy in the Netherlands as evidenced by the policy analysis, media analysis and expert interviews (stage 2 of the methods). Section 5.3.2 analyses these findings in light of the conceptual framework and its circularity discourse typology. Section 5.3.3 presents the statistical analysis and interpretation of the Q-Survey results and describes the different resulting perspectives regarding the transition to a sustainable circular plastics economy (stage 5 of the methods).

5.3.1 Results from the analysis of the concourse

As part of its CE Action Plan, the European Commission adopted the "European Union Strategy for plastics in a Circular Economy" which addresses issues like recyclability, biodegradability, the presence of hazardous substances in certain plastics, and marine litter (European Commission, 2018). Several plastic specific Directives were implemented to address these issues, such as Directive 2019/904 on the reduction of the impact of certain plastic products on the environment, which banned several single-use plastic products such as cotton buds, cutlery, stirrers, plates and straws and established eco-design and separate collection requirements for single-use plastic bottles. Moreover, the EU set new recycling targets for plastic packaging (50% by 2025 and 55% by 2030) (Directive 2018/852) and established the obligation for the separate collection of municipal plastic waste (Directive 2018/851).

In addition to this, the EU has mandated the establishment of extended producer responsibility (EPR) systems to manage plastic packaging waste (Directive 2018/852). An EPR system is a policy mechanism by which the administrative, financial, and physically responsibility to manage the entire life cycle of a product, and especially, the take-back, recycling and final disposal, is given to the producers or importers of a product rather than to the government (Lindhqvist, 2000).

Three key policies regulate plastic waste within the Netherlands, the "National Waste Plan" established in 2003, as well as the "Packaging and Paper and Cardboard Management Decree" and the "Framework Agreement on Packaging and Litter", which were both established in 2007. These policies set minimum plastic packaging recycling targets which rose from 32% in 2009 to 38% in 2010, and further to 42% in 2012. They also created a deposit system for large PET bottles and established the Dutch EPR system for packaging waste. These policies were updated in 2014 to increase the minimum recycling targets from 43% in 2013 to 52% in 2022 (with an increase of 1% per year).

The producers and importers of plastic packaging founded *Afvalfonds Verpakkingen* to collectively implement their obligations under the abovementioned policies (it is the so-called producer responsibility organization or PRO (Kalimo et al., 2015), which is responsible for the implementation of the packaging EPR system in the Netherlands). *Afvalfonds Verpakkingen* is financed by the packaging industry via a 'waste management contribution fee'. This fee must be paid by producing and importing organisations when they bring and/or discard 50,000 (or more) kilos of packaging on the Dutch market, even if an organisation is located outside the Netherlands.

The organisational and financing structure of *Afvalfonds Verpakkingen* and its recovery activities is presented in Figure 5.7.

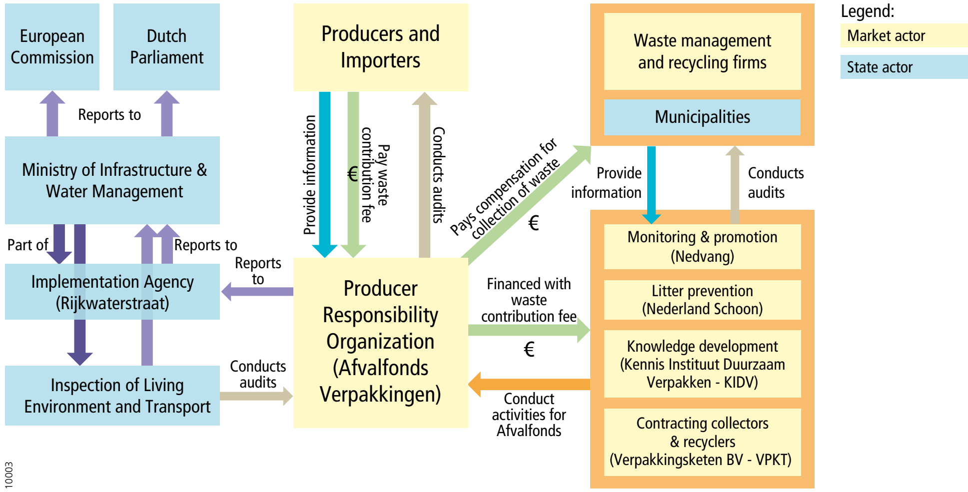

FIGURE 5.7 | EPR-system of packaging in the Netherlands (source: developed by authors based on *Afvalfonds Verpakkingen*, 2018).

Each Dutch municipality organizes their waste collection system independently, thereby resulting in a multiplicity of different collection systems. *Afvalfonds Verpakkingen* compensates municipalities for their collection by paying a specific fee based on the volume and quality of waste they collect. While this incentivises an efficient collection, it also means that some municipalities which have poorly separated waste, don't receive enough compensation to cover their costs. In those cases, the costs for collection are not fully covered by *Afvalfonds Verpakkingen*, but rather by local taxpayers (Gradus, 2020).

In 2016, the Dutch government established its national CE strategy "A circular economy in the Netherlands by 2050", where it set the ambition to reduce raw materials consumption by 50% in 2030 and to become 100% circular by 2050 (Government of Netherlands, 2016). This policy established plastics as one of the central components of the transition and seeks that "in 2050, 100% renewable (recycled and biobased) plastics will be used without any harmful impact on the environment, wherever such is technically feasible" (p. 51).

In the following years, the "National agreement on the circular economy (2017)", the "Transition agenda of plastics (2018)", and the "Plastic Pact NL (2019)" were enacted as part of this commitment. The above policies represent various multi-stakeholder agreements, containing voluntary commitments from a wide variety of market, state, and civil society actors (see supplementary materials B of Calisto Friant et *al.* (2022a) with a list of pact members). They notably set several voluntary targets for 2025, such as ensuring that all single-use plastic packaging is 100% recyclable; reducing plastic usage by 20% (in kg) compared to 2017; reaching a 70% rate of plastic packaging recycling; ensuring that new plastic packaging contains at least 35% recycled content and increasing the use of sustainably produced biobased plastics (Plastic Pact NL, 2021).

In July 2019, a third "National Waste Management Plan" was implemented. It prohibited landfilling and incineration without energy recovery for all sorts of plastic waste as well as the export of plastic waste for landfilling or incineration.

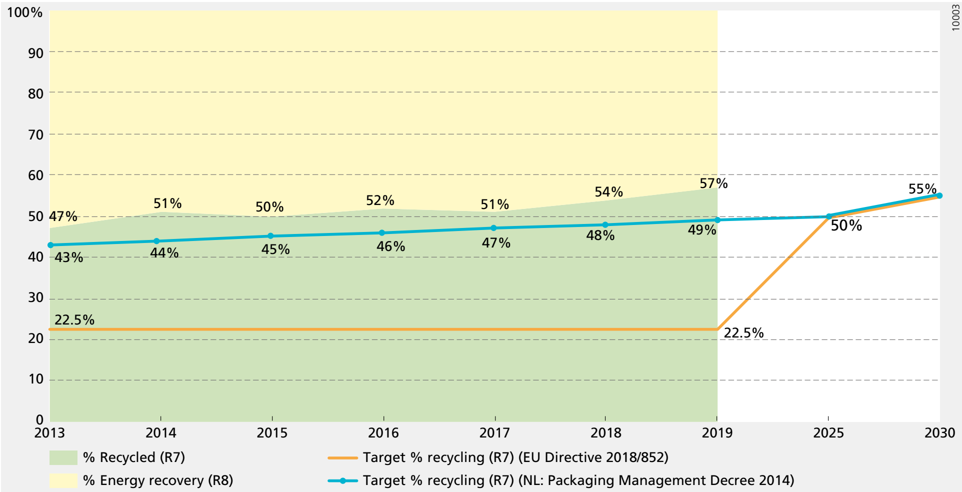

FIGURE 5.8 | Results of recycling (R7) targets and energy recovery (R8) rates for plastic packaging of between 2013 – 2019 (author's work based on Afvalfonds Verpakkingen annual monitoring reports 2013 – 2019, see supplementary materials F of Calisto Friant et *al.* (2022a) for full data).

The performance of the plastic recovery operations of *Afvalfonds Verpakkingen* can be seen in Figure 5.8 (numbers in green represent recycling figures). It shows that the Dutch and European recycling targets were largely achieved, and that recycling rates improved almost every year except for 2017. According to *Afvalfonds Verpakkingen*, China's ban on the import of post-consumer plastic waste was a key factor explaining this setback (Annual monitoring report of 2017, p. 5). In fact, there is insufficient recycling capacity in the country and Europe as a whole[44] (Gradus, 2020). Therefore, Afvalfonds Verpakkingen is highly dependent on the export of its waste to third countries to fulfil its recycling targets and the Netherlands is thus one of the leading exporters of plastic waste in the world (Brooks et al., 2018; C. Wang et al., 2020). While data on the exact amount of Dutch plastics which are exported for recycling are unavailable, studies have found that, in the EU, as much as 46% of plastics that are destined for recycling are exported (Bishop et al., 2020).

The problem with this is that it is very hard to control what happens to plastic waste once it is exported. Although exports of plastics are highly regulated under international law, actual controls are rather weak, so it is virtually impossible to guarantee how plastic waste will actually be processed and where it will end up[45]. In practice, plastic waste changes

44 Interview with Director of a consultancy firm on CE

45 Interview with Associate Director of a consultancy firm on CE and interview with Director of consultancy firm in biotechnology

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hands multiple times along complex international trading routes, causing many leakages to the environment along the way and often ending up in countries in the Global South will little capacity to recycle it sustainably (Barnes, 2019). A large proportion of European plastic waste which is reported as recycled thus ends up in landfills or in rivers and oceans across the globe (Bishop et al., 2020). Even Afvalfonds Verpakkingen recognised, in their 2017 monitoring report, that "*there is uncertainty about the quantities and actual recycling of plastic packaging waste that has been exported to customers outside the EU*" (p. 44). Moreover, recent research has found that actual Dutch recycling figures for 2017 were closer to 23% than the reported 51% (Brouwer et al., 2019; Picuno et al., 2021). According to Bishop et al., the Netherlands is in fact, the 5th largest European contributor to ocean plastic debris (in yearly kg of plastic debris per capita) (Bishop et al., 2020). Moreover, research suggests that China's ban will likely further increase the rate of mismanaged plastic as plastic waste exports are now being channelled to other countries with lower capacities to process and recycle plastic waste in a sustainable manner (Bishop et al., 2020).

It is also worth noting that there is little demand for recycled plastic in the Netherlands, Europe and the world as a whole because of its higher price and lower quality compared to virgin plastic[46]. As an interviewee mentioned, "*99% of the producers choose virgin plastics because it is cheaper and trustable. The quality is safer*"[47]. This means that most recycled plastic is not re-used in high-quality products and applications, and much of it ends up stockpiled until it finds a buyer[48]. In fact, the actual use of recycled plastic in new plastic products is only around 10% in the Netherlands (Verrips et al., 2019).

5.3.2 Analysis of Dutch Policies

From the above results, it is evident that current CE practices in the Netherlands are primarily focused on eliminating landfilling and incineration and replacing it with energy recovery (R8) and recycling (R7). While recovery figures are quite high compared to other countries (the average rate of plastic packaging recycling in the EU was 41,4% in 2018), the Netherlands is highly dependent on the export of plastic waste to obtain these results. The Dutch plastic recovery system might thus lead to significant unintended socio-environmental impacts throughout the world.

In addition to this, the Netherlands is still highly dependent on energy recovery (R8, see Figure 5.8). While energy recovery can reduce C02 emissions by 30 to 45% compared to traditional electricity generation with fossil fuels, it is not a clean process as it produces significantly more greenhouse gases than recycling or re-using packaging (Vollmer et al., 2020). Energy recovery also creates toxic residues that must ultimately be landfilled (about 1.5 to 2% of the net incinerated weight) (Picuno et al., 2021). Moreover, it fuels the need to continuously produce more virgin plastic; thereby reproducing a linear system.

46 Interview with Professor in plastic packaging of Dutch University

47 Interview with Senior Policy Advisor of local governments

48 Interview with Business Development Manager of large recycling firm

The Plastic Pact NL has set targets that go beyond recycling and incineration, such as consumption reduction (R0 refuse) and recycled content (R1 reduce) objectives. However, those goals are purely voluntary; companies can therefore agree to those strong commitments to be perceived as greener and more sustainable, without facing many repercussions if they don't reach them (Mah, 2021; Stafford and Jones, 2019; Verrips et al., 2019). In fact, research shows that voluntary agreements and partnerships are often used as key greenwashing strategies for corporations in the plastic sector to improve brand reputation and reduce regulatory pressure (Mah, 2021).

The Dutch Government's target to become 100% circular by 2050 is quite ambitious, yet it is unclear how this will be measured and implemented. It could mean that all manufacturing and recovery operations are delocalized to other countries, thereby exporting environmental impacts from industrial activities, while still allowing for an increase in the consumption of manufactured goods. This goal might therefore not guarantee that overall environmental impacts will be reduced on a global scale. Furthermore, it is, in reality, impossible to create a perfectly circular economy due to the second law of thermodynamics, which demonstrates the inevitability of entropy as materials and energy are irreversibly dissipated in any physical process (Korhonen et al., 2018a; Mayumi and Giampietro, 2019; Millar et al., 2019; Rammelt and Crisp, 2014). This means that it is technically impossible to recycle plastics over and over again as material quality degrades over time and a significant portion is lost in each recovery cycle (Cullen, 2017; Genovese and Pansera, 2020; Giampietro and Funtowicz, 2020; Skene, 2018). The Dutch Government's goal to achieve full circularity is thus more of a symbolic objective than a realistic aim.

Moreover, the Dutch Government placed economic growth as a cornerstone of its CE strategy, which is seen as bringing plenty of "opportunities for sustainable economic growth" (p.42) and which relies heavily on an "absolute decoupling of economic growth from environmental impact" (p. 10) (Government of Netherlands, 2016). This commitment to green growth is clearly within the *Technocentric Circular Economy* perspective (see figure 5.2), and was chosen despite the fact that academic research has clearly evidenced that absolute decoupling is not happening and will most likely never happen on a scale relevant to significantly reduce current unsustainable patterns of resource use, greenhouse gas emissions, and overall environmental degradation (Haberl et al., 2020; Hickel and Kallis, 2019; Jackson and Victor, 2019; Parrique et al., 2019).

All in all, the voluntary targets of the Plastic Pact and the 100% circularity objective of the Dutch CE strategy seem to be less science-based goals than marketing stances which allow these actors to be perceived as global leaders and front-runners in the CE transition. In fact, these strong commitments appear rather ambitious and progressive, yet they are not binding. Meanwhile, the policies which are actually compulsory in the Netherlands are doing little to fundamentally transform the linear plastic production and consumption systems.

Indeed recycling (R7) remains the core CE value retention strategy in Dutch policies and the only one with mandatory targets. Yet, recycling has clear limitations and cannot by itself lead to a sustainable circular plastic economy without strong policy measures and targets on higher value retention options such as reducing virgin plastic consumption (R0 refuse), eco-design requirements to reduce the environmental impact of plastics (R1 reduce), and the promotion of re-usable packaging (R2 reuse)(Greenwood et al., 2021; Verrips et al., 2019; Vollmer et al., 2020).

It is also important to note that Dutch policies do not include specific social justice components. They thus don't address key issues regarding who pays for the transition, who controls CE technologies and how to support countries in the Global South, where a substantial share of Dutch plastic waste currently ends up (Bishop et al., 2020). All in all, it is clear from the above analysis, that the Dutch government's approach to a CE transition for plastics follows a *Technocentric Circular Economy* perspective (see Figure 5.2).

5.3.3 Analysis of Dutch societal discourse on the transition to a sustainable circular plastics economy

This section represents stage 5 of the methodology, whereby participant Q-sorts were analysed with the PQmethod software. This factor analysis led to the description of 4 different perspectives, which reflects 4 statistically significant discourses on the transition to a CE for plastics in the Netherlands (see Figure 5.9). These 4 perspectives were analysed and interpreted based on the Z-scores of their ranked statements (see supplementary materials G of Calisto Friant et *al.* (2022a) with the full statistical output of the PQmethod software). A *Z*-score is a standardized score on the statistical importance of each statement for each perspective. Statements with a Z-score of larger than 1 demonstrate relative agreement and smaller than -1 demonstrate relative disagreement. The analysis also looks at statistically significant distinguishing statements for each perspective. These distinguishing statements have z-scores which are significantly different between perspectives and therefore denote key points of disagreement between the 4 discourses[49].

49 Distinguishing statements are statistically significant at $p < 0.05$, and values indicated by an asterisk (*) have a statistical significance at $p < 0.01$.

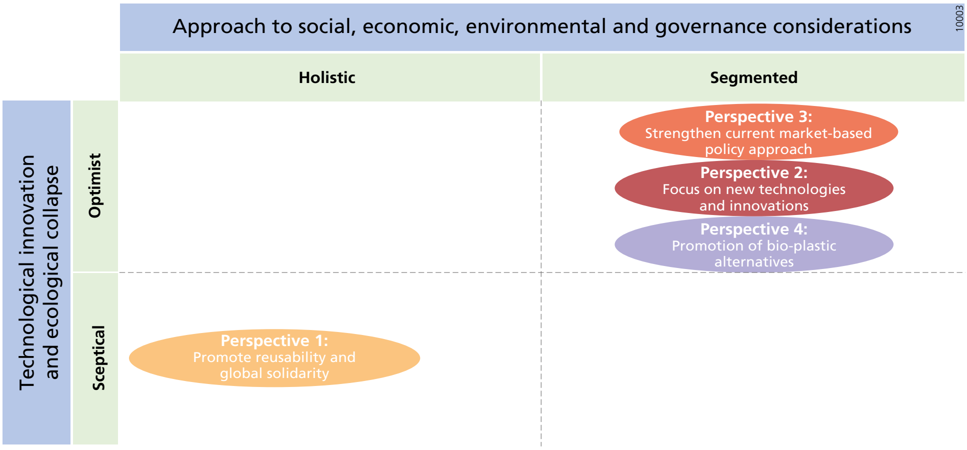

FIGURE 5.9 | 4 perspectives resulting from factor analysis and the circularity discourse type.

5.3.3.1 Perspective 1: Promote reusability and global solidarity

This perspective was represented by people from civil society organisations, government agencies, and research institutes. Figure 5.10 shows the Z-scores of this perspective and Table 5.4 shows the statistically significant distinguishing statements between perspective 1 and all other perspectives. The data demonstrates that this perspective seeks strong policy actions to reduce plastic consumption with a high support for statements such as promoting reusable packaging, banning non-recyclable plastics (#36), reducing the overall use of plastics per capita (#42), and expanding deposit return systems (#10).

Moreover, this perspective seeks to increase the use of recycled plastic in new products by taxing virgin fossil-based plastics and non-recyclable plastics (#39), designing for sustainability and recyclability (#11), discouraging incineration (#12), and setting high minimum requirements for recycled plastic content in new plastic products (#30).

This perspective also has a rather strong commitment to global solidarity as it is in favour of banning of export of plastic waste outside the EU (#2), and providing financial assistance and technology transfers to countries in the Global South so they can better manage plastic waste (#17).

Moreover, this perspective is strongly opposed to reducing state control as it is strongly opposed to statements favouring less regulatory constraints for bio-based, biodegradable, recycled plastics (#33), and increasing consumer responsibility (#8).

Overall considering the emphasis of this perspective on social change towards reusable packaging and reduced plastic consumption and its support for global solidarity, this perspective is most aligned with the *Transformational Circular Society* discourse type (Calisto Friant et al., 2020).

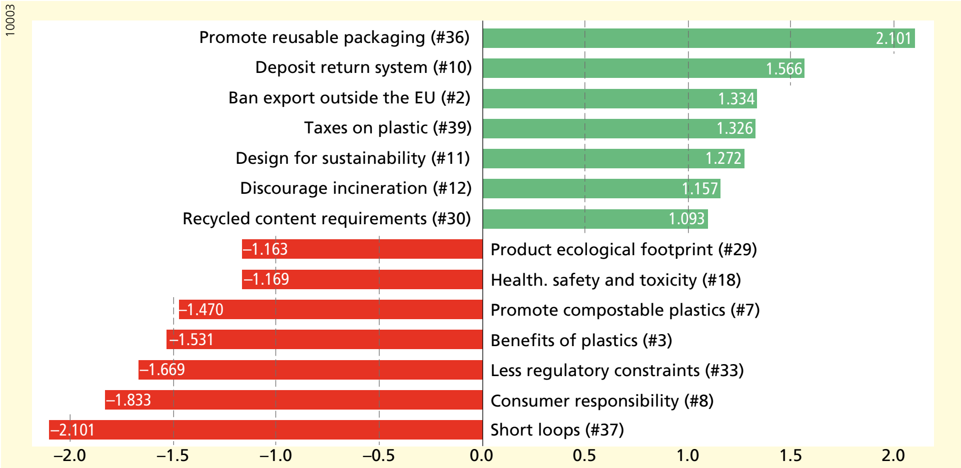

FIGURE 5.10 | Perspective 1: most (green) and least (red) important Q statements with Z-score < -1 and > 1.

TABLE 5.4 | Significant distinguishing statements of perspective 1 at $p < 0.05$ and marked with '*' at $p < 0.01$.

#	Q statements	Perspective 1 Z-score	Perspective 2 Z-score	Perspective 3 Z-score	Perspective 4 Z-score
#36	Promote reusable packaging	2.10*	-0.97	0.54	-0.90
#10	Deposit return system	1.57*	-0.65	0.48	-1.19
#24	Ban non-recyclable plastics	0.90*	-1.10	-0.03	-0.81
#17	Global solidarity	0.85*	-0.60	-1.04	-0.72
#42	Reduce virgin plastic consumption	0.65*	-1.58	-1.36	-1.38
#5	Regulate bio-based plastics	-0.43*	0.59	0.79	-1.76
#7	Promote compostable plastics	-1.47	-0.66	-0.02	1.95
#3	Benefits of plastics	-1.53*	1.38	0.95	-0.19
#33	Less regulatory constraints	-1.67	-0.79	-1.02	1.33
#8	Consumer responsibility	-1.83*	0.85	0.92	-0.10
#37	Short loops	-2.10	-0.54	-0.65	-1.09

5.3.3.2 Perspective 2: Focus on new technologies and innovations

This perspective was represented by people from the business sector such as plastic-applying organisations, plastic producing organisations, and waste management companies. From Figure 5.11 and Table 5.5, it is clear that this perspective is highly focused on improving recycling rates with policies such as creating a single system for waste management in all municipalities to generate efficient economies of scale for plastic recovery operations (#41), discouraging incineration (#12), design for sustainability and recyclability (#11), marketing on recyclability (#22), expanding EPR to other plastics (#15), and improving enforcement and control (#14).

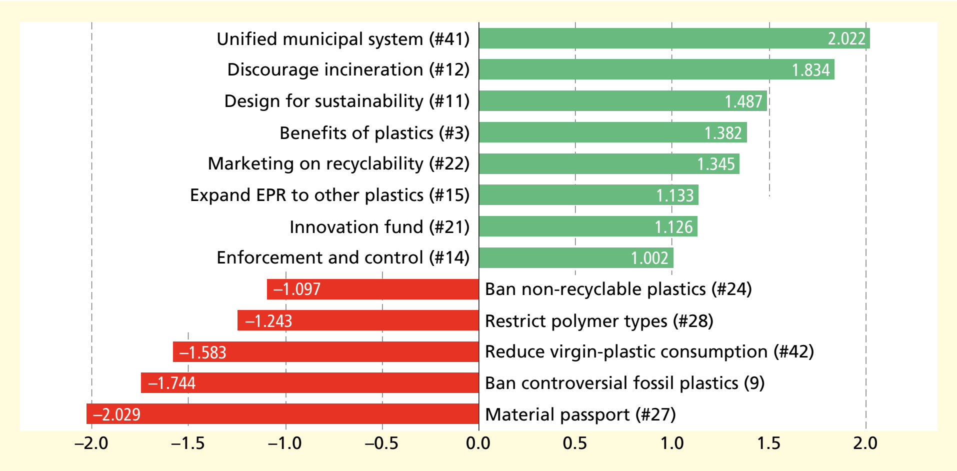

FIGURE 5.11 |Perspective 2: most (green) and least (red) important Q statements with Z-score < -1 and > 1.

TABLE 5.5 | Significant distinguishing statements of perspective 2 at p < 0.05 and marked with '*' at p < 0.0.

#	Q statements	Perspective 1 Z-score	Perspective 2 Z-score	Perspective 3 Z-score	Perspective 4 Z-score
#41	Unified municipal system	0.20	2.02*	0.17	0.34
#25	Open-source innovations	-0.44	0.87	-0.27	-0.15
#39	Taxes on plastic	1.33	0.49	2.27	1.71
#38	Employment and social inclusion	-0.72	0.42	-1.26	-0.52
#35	Restrict sales in Global South	0.81	-0.65	-1.27	0.95
#7	Promote compostable plastics	-1.47	-0.66	-0.02	1.95
#30	Recycled content requirements	1.09	-0.94*	1.46	1.47
#9	Ban controversial fossil plastics	-0.09	-1.74*	-0.60	-0.28
#27	Material passport	0.39	-2.03*	0.39	0.05

This perspective is also focused on developing new technologies and innovations with policy actions such as promoting open-source technologies (#25) and establishing a fund focused on innovation and R&D of circular solutions (#21).

Moreover, this perspective is highly opposed to strong government actions such as bans on non-recyclable plastics (#24), bans on plastics made from controversial sources such as tar sands and shale gas (#9), and restrictions on polymer types allowed in the market (#28).

In addition to this, this perspective finds it is highly important for the media to better communicate the health and environmental benefits of plastics (#3).

Overall, the above statements demonstrate a high level of optimism regarding technological change and recycling innovations. It also shows a larger focus on market-based solutions such as EPR schemes, eco-design, and product marketing rather than strong government actions such as bans and restrictions. Moreover, this perspective did not give high importance to any social policies, thereby demonstrating a segmented view on the topic. This perspective thus clearly falls within the *Technocentric Circular Economy* discourse type (Calisto Friant et al., 2020).

5.3.3.3 Perspective 3: Strengthen current market-based policy approach

This perspective is represented by a wide range of people from government institutions, plastic applying organisations, consultancies, civil society organisations, and waste management companies.

By analysing results in Figure 5.12 and Table 5.6, it is clear that this perspective is mostly characterized by the statements it is opposed to rather than those it found important. It is thus opposed to transformational social justice policies such as creating a fair system where the costs of a circular economy transition for plastics do not fall on the poorest and most vulnerable people (#16), improving the participation of civil society organizations in the EPR system (#19), restricting the sale of non-compostable plastics in the Global South (#35), helping the employment and inclusion of workers from the linear plastic and fossil-fuel industry towards a circular plastic economy (#38), and establishing a fund to clean plastics in the oceans and other natural ecosystems (#6).

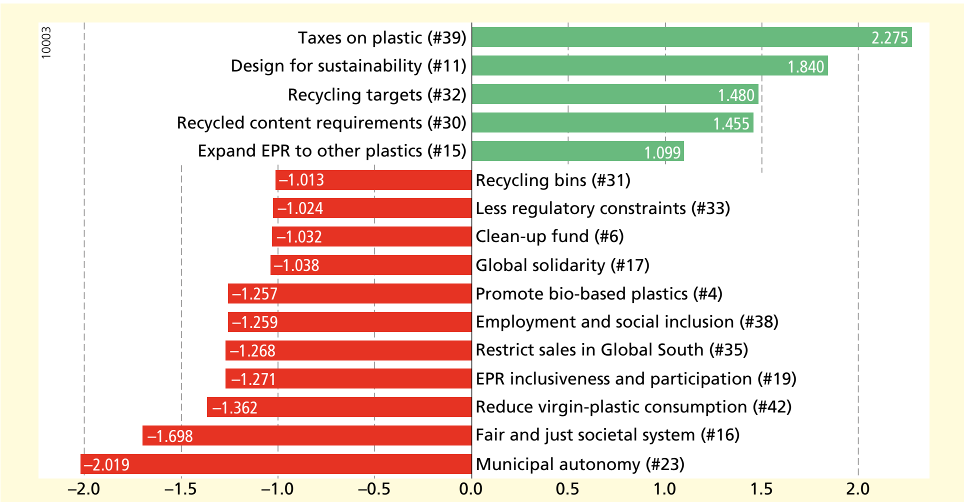

FIGURE 5.12 | Perspective 3: most (green) and least (red) important Q statements with Z-score < -1 and > 1.

This perspective also finds the improvement of the current recycling systems rather important with policies such as increasing recycled content requirements (#30), and rising recycling targets (#32). Yet this perspective is opposed to more transformational policy actions such as restricting polymer types in the market (#28), reducing virgin plastic consumption (#42) and greater municipal autonomy to develop small-scale disruptive innovations (#23).

All in all, considering the abovementioned results, which don't place any social justice policies as important, and heavily focus on bioplastics as a technologically innovative alternative to fossil plastics, it is clear that perspective 4 falls within the *Technocentric Circular Economy* discourse type (Calisto Friant et al., 2020).

TABLE 5.6 | Significant distinguishing statements of perspective 3 at $p < 0.05$ and marked with '*' at $p < 0.01$.

		Perspective 1	Perspective 2	Perspective 3	Perspective 4
#	Q statements	Z-score	Z-score	Z-score	Z-score
#28	Restrict polymer types	-0.57	-1.24	0.88*	-1.90
#20	Increase EPR fees	-0.37	-0.67	0.56	-0.38
#36	Promote reusable packaging	2.10	-0.97	0.54*	-0.90
#29	Product ecological footprint	-1.16	-0.62	0.48*	-1.05
#10	Deposit return system	1.57	-0.65	0.48*	-1.19
#7	Promote compostable plastics	-1.47	-0.66	-0.02	1.95
#24	Ban non-recyclable plastics	0.90	-1.10	-0.03	-0.81
#35	Restrict sales in Global South	0.81	-0.65	-1.27	0.95
#19	EPR inclusiveness and participation	-0.36	0.24	-1.27*	-0.05
#16	Fair and just societal system	0.17	0.69	-1.70*	0.67

5.3.3.4 Perspective 4: Promotion of bio-plastic alternatives

This perspective was represented by people from waste management companies, research institutes, and plastic-producing organisations. Looking at results from Figure 5.13 and Table 5.7 demonstrates that this perspective is heavily focused on policies supporting bio-plastics with statements such as promoting the use of compostable plastics (#7), increasing taxes on virgin fossil-based plastics and non-recyclable plastics (#39), encouraging and increasing the use of bio-based plastics (#4), reducing regulatory constraints for bio-based, biodegradable, and recycled plastics, especially for food-uses (#33), and promoting sustainable alternative materials to plastics (#1). Moreover, this perspective is opposed to regulating bio-based plastics so they don't compete with food production and biodiversity conservation (#5).

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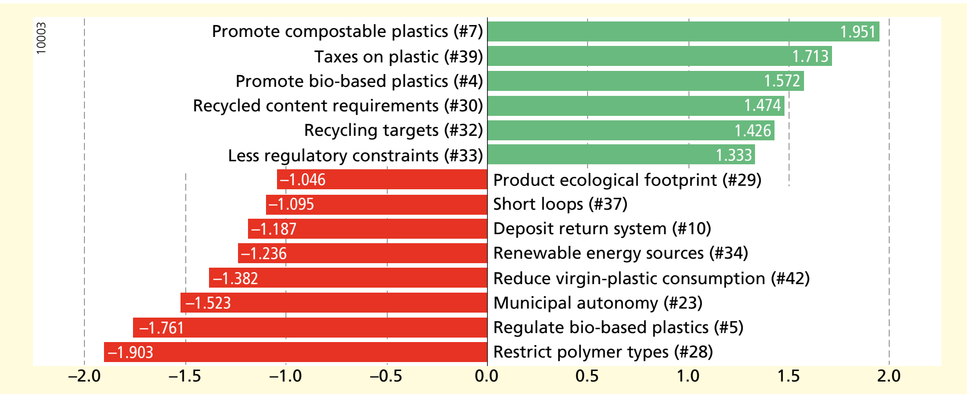

FIGURE 5.13 | Perspective 4: most (green) and least (red) important Q statements with Z-score < -1 and >1.

TABLE 5.7 | Significant distinguishing statements of perspective 4 at $p < 0.05$ and marked with '*' at $p < 0.01$.

#	Q statements	Perspective 1	Perspective 2	Perspective 3	Perspective 4
		Z-score	Z-score	Z-score	Z-score
#7	Promote compostable plastics	-1.47	-0.66	-0.02	1.95*
#4	Promote bio-based plastics	-0.59	-0.81	-1.26	1.57*
#33	Less regulatory constraints	-1.67	-0.79	-1.02	1.33*
#1	Alternatives to plastic	-0.41	-0.37	-0.09	0.95*
#8	Consumer responsibility	-1.83	0.85	0.92	-0.10
#3	Benefits of plastics	-1.53	1.38	0.95	-0.19*
#15	Expand EPR to other plastics	0.68	1.13	1.10	-0.76*
#5	Regulate bio-based plastics	-0.43	0.59	0.79	-1.76*

This perspective also finds the improvement of the current recycling systems rather important with policies such as increasing recycled content requirements (#30), and rising recycling targets (#32). Yet this perspective is opposed to more transformational policy actions such as restricting polymer types in the market (#28), reducing virgin plastic consumption (#42) and greater municipal autonomy to develop small-scale disruptive innovations (#23).

All in all, considering the abovementioned results, which don't place any social justice policies as important, and heavily focus on bioplastics as a technologically innovative alternative to fossil plastics, it is clear that perspective 4 falls within the *Technocentric Circular Economy* discourse type (Calisto Friant et al., 2020).

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5.4 Discussion

This section discusses the implications of the results and proposes recommendations for the transition to a sustainable circular plastics economy. It also discusses the limitations of this research.

5.4.1 The plastic discourse in the Netherlands

Results from the policy analysis found that the Dutch government followed a *Technocentric Circular Economy* approach to a CE transition in the plastics sector. Results from the factor analysis found that perspectives two, three, and four also follow a *Technocentric Circular Economy* discourse, while only one perspective followed a *Transformational Circular Society* discourse. These results indicate that both Dutch societal perspectives and public policies are dominated by *Technocentric Circular Economy* discourses. This is in line with results from Palm et al. (2021) who found that the most dominant plastic narratives in government and industry sectors in Europe also fall within the *Technocentric Circular Economy* discourse type.

Plastic governance in the Netherlands is thus not geared towards social justice or reduced plastic consumption and ecological footprints. Instead, it focuses on recycling solutions, whereby people are brought to believe that they can continue consuming more plastic as long as they throw it in the right bin. It thereby obscures the complex technological and logistical challenges of recycling and its impacts on people and ecosystems throughout the world by creating an illusion of perfect circularity, which incentivises further plastic consumption (Barnes, 2019; Giampietro and Funtowicz, 2020; Valenzuela and Böhm, 2017).

To understand why this is the dominant framing of the plastic problem, it is important to acknowledge that the Netherlands is a key player in the global plastic industry with hundreds of producing firms in the sector generating a turnover of 17.5 billion euros (2% of Dutch GDP) in 2014 and exporting 83% of their production (Grin, 2018). The powerful oil sector has also strongly pushed for an increased production of plastics as the biggest future use of fossil-fuels, now that their use as energy sources must be reduced to comply with climate change commitments.(Bauer and Fontenit, 2021; Mah, 2021) There are thus strong lock-ins that tie the economic and geopolitical interests of the Netherlands with the plastic industry and thereby incentivise discourses and policies that don't threaten its position as one of the top plastic producers and exporters in the world(Bauer and Fontenit, 2021).

Another way to explain the dominance of *Technocentric Circular Economy* perspectives in the Netherlands is by acknowledging the role of highly processed foods, and the delivery industry in fostering the dependency on plastic packaging. E-commerce has greatly increased the demand for plastic packaging from the delivery industry, in particular for online food delivery services (Arunan and Crawford, 2021; Su et al., 2020). The rising consumption of ultra-processed foods also contributes to an increased dependence on plastic packaging (Fardet and Rock, 2020). Plastic packaging consumption in the Netherlands has thus risen by 11.75% from 2013 to 2019 (see supplementary materials of Calisto Friant et al. (2022a) F for full data). The continuous growth and convenience of plastic packaging thereby limits the possibility of imagining a reduction in its consumption, through re-fuse (R-0), re-deuce (R0), and re-use (R2) alternatives; and instead, biases current discourses and policies towards improved collection, recycling (R7) and recovery (R8) strategies.

5.4.2 Policy recommendations

The results from the factor analysis also allow us to see which statements are considered most important by all four perspectives (see Table 5.8). This can evidence points of consensus for certain policies, which might be quickly implemented as low-hanging fruits for the transition to a sustainable circular plastics economy in the Netherlands.

TABLE 5.8 | Q-statements with the highest Z-Scores across all 4 perspectives.

#	Q-Statement	Persp. 1	Persp. 2	Persp. 3	Persp. 4	SUM
#39	Taxes on plastic	1.326	0.492	2.275	1.713	1.452
#11	Design for sustainability	1.272	1.487	1.840	0.905	1.376
#12	Discourage incineration	1.157	1.834	0.760	0.569	1.080
#32	Recycling targets	0.636	0.390	1.480	1.426	0,983
#2	Ban export outside the EU	1.334	0.454	0.810	0.715	0.828
#30	Recycled content requirements	1.093	–0.943	1.455	1.474	0.770
#41	Unified municipal system	0.203	2.002	0.174	0.336	0.679
#22	Marketing on recyclability	0.110	1.345	0.840	0.380	0.669
#15	Expand EPR to other plastics	0.678	1.133	1.099	–0.764	0.537
#21	Innovation fund	0.355	1.126	–0.019	0.569	0.508

Short-term policy recommendations, with strong support across societal stakeholders:

1. *Tax virgin fossil-based plastics and non-recyclable plastics and reduce the taxes on recycled plastics (statement* #39). The price of virgin plastics remains too low for recycling to be an economically competitive alternative (Cramer, 2018; Forrest et al., 2019). Taxes can thus make virgin fossil-based plastics and non-recyclable plastics more expensive and thereby stimulate the production and uptake of recycled plastics (Barrowclough and Birkbeck, 2020; Verrips et al., 2019).
2. Establish a fund focused on innovation and R&D of circular solutions (such as new sorting and recycling technologies) financed by fees on virgin materials (statement #21). Resources are still needed to improve the cost-effectiveness, eco-efficiency, and commercial readiness of new technologies (Cramer, 2018; Ragaert et al., 2017). A fund could thus provide much-needed financial resources while also reducing the competitiveness of unsustainable virgin materials (Barrowclough and Birkbeck, 2020; Verrips et al., 2019).
3. Establish financial and legal incentives to discourage the incineration of lower-grade plastics (with or without energy recovery) and promote their recycling (statement #12). In the Netherlands, the costs of recycling outweigh those of energy recovery by as much as 36,7% (Gradus et al., 2017). Financial and legal incentives with key targets to reduce energy recovery could thus help make recycling a more cost-effective solution.
4. Design for recyclability and lower overall environmental impacts throughout a product's lifecycle (including resource use and hazardous substances) (statement #11). Plastic products currently contain a large number of different polymer types and additives, which provide specific textures, colours, and properties, but that heavily reduce recyclability (Simon, 2019). Moreover, there is no evidence showing that EPR systems lead to changes in the eco-design of products to make them more easily recyclable or longer-lasting (Campbell-Johnston et al., 2020a; Deutz, 2009; Kunz et al., 2018; Maitre-Ekern, 2021; Micheaux and Aggeri, 2021). To improve recycling potential and reduce the overall environmental impact of plastic packaging, it is thus key to

establish direct eco-design regulations that limit the number of additives, multilayer and composite plastic materials and support the use of sustainable alternatives (Gradus, 2020; Mah, 2021). The eco-modulation of EPR fees is a key manner to achieve this objective, whereby producers pay EPR fees based on the environmental impact and recyclability of their product, thereby directly incentivising eco-design innovations (Campbell-Johnston et al., 2021; Kunz et al., 2018; Picuno et al., 2021; Vermeulen et al., 2021; Watkins et al., 2017).

5. *Increasing plastic recycling targets (statement #32)*. The Plastic Pact NL voluntary commitment to reach a 70% recycling rate by 2025 could become a mandatory target to stimulate the industry and reduce the risks of free-riders.
6. *Set minimum requirements for recycled plastic content in new plastic products (statement #30)*. The current use of recycled plastic in new products is only about 10% in the Netherlands (Verrips et al., 2019) it is thus key to set new mandatory targets which help create new market avenues for recycled plastics.
7. Ban the export of plastic waste outside Europe so plastic waste is recycled and processed within European borders (statement #2). This policy is key to ensure that plastics are properly recycled and don't end up causing more harm to human health and ecosystems (Barnes, 2019; Bishop et al., 2020). Not only will this stimulate the recycling industry in the EU, but it will also allow countries in the Global South to focus the little recycling capacity they have on their own plastic waste.

While they are important, the above policies alone are not enough to create a fair and inclusive transition towards a sustainable circular plastics economy. Other key policies, which might not have the strongest support, are thus necessary, especially considering the recommendations of previous research in the area.

Policy recommendations, which are important from a sustainability and circularity perspective:

1. Afvalfonds Verpakkingen should include civil society organisations and local and national government representatives in a participatory and inclusive manner so that its decisions regarding plastics are more democratic, transparent and inclusive (statement #26). Evidence from this and other research shows that EPR systems tend to choose the cheapest and most profitable recovery option rather than the most social and environmentally sustainable options (Campbell-Johnston et al., 2020a; Kalimo et al., 2015; Steenmans, 2019). This is why most of the waste in the Netherlands is currently incinerated or exported to the Global South. While EPR costs are born by society, which pays the EPR fee and suffers the consequences of plastic pollution and incineration, people currently have no say on how EPRs are managed. It is therefore key to increase the democratic inclusiveness of the system by placing civil society organizations and local government representatives in the board of *Afvalfonds Verpakkingen*, with an equal say in decisions compared to private actors. The EPR system would thus not only become more inclusive but will also create full transparency and accountability

regarding what happens to collected plastics. This can thus lead to key improvements in the social and environmental performance of the EPR system (Campbell-Johnston et al., 2021, 2020a; Kalimo et al., 2015; Micheaux and Aggeri, 2021).

2. *Establish targets to reduce overall plastic consumption per capita (statement #42)*. Reducing overall plastic consumption is the ultimate aim of any CE policy for plastics according to academics and practitioners alike (Barnes, 2019; Ghisellini et al., 2016; Palm et al., 2021; WEF et al., 2016). It is thus key to focus on this goal as a binding policy target.
3. *The government and companies should highly increase the use of reusable packaging (statement #36)*. Reusable packaging has been in a steady decline in the last decades(Coelho et al., 2020). Yet, it has a unique potential as it can lead to both economic savings and environmental impact reductions compared to single-use options. Studies have found that reusable packaging outperforms single-use packaging for both business-to-business and business-to-consumer applications (Boesen et al., 2019; Coelho et al., 2020; Greenwood et al., 2021). Moreover, reusable packaging enjoys renewed customer acceptance (Greenwood et al., 2021). To facilitate the deployment of reusable packaging options, the state can establish deposit-refund systems and reduce taxes for reusable packaging (Verrips et al., 2019). In addition to this, an eco-efficient and customer-friendly design of standardised reusable packaging containers, bottles, crates, and logistical systems should be established to improve the economic and environmental efficiency of return systems.
4. The government should establish a fair and just societal system to make sure that all the fees and costs of a circular economy transition for plastics do not fall on the poorest and most vulnerable people (statement #16). The EPR fees and the additional taxes which are suggested as policy options above will increase the overall price of products for consumers in a regressive manner (those that have the least will pay the most as a percentage of their income) (Maitre-Ekern, 2021; Verrips et al., 2019). To compensate for this, it is key to redistribute some of these resources to low-income communities through projects and initiatives that employ vulnerable and disenfranchised groups and support local livelihoods (Barrowclough and Birkbeck, 2020). Pay-as-you-throw systems, which reward people for recycling could also be established to redistribute part of the collected taxes and fees (Kunz et al., 2018).
5. Government and companies from the Global North should provide financial assistance and technology transfers to countries in the Global South so they can better manage plastic waste (statement #17). Waste management infrastructure and technology is very expensive, in low-income countries it can be the single highest budget item for municipal governments (Bishop et al., 2020). Yet these countries must deal with many other key sustainability issues from poverty to climate change and lack of housing (Calisto Friant, 2019). Therefore, they require significant amounts of financial and technical assistance to help them develop their waste management infrastructure (Barnes, 2019; Barrowclough and Birkbeck, 2020). Fostering open-source technologies

can also help in this regard as they can spread circular innovations and solutions throughout the world and democratize the transition to a circular economy and society (Genovese and Pansera, 2020).

6. The government and companies from the Global North should establish a fund to finance clean-up activities of plastics in the oceans and other natural ecosystems (statement #6). Plastic pollution is ultimately a "collective action problem", which requires global action to succeed (Vince and Hardesty, 2018). Those that produce and consume the most plastics and have the greatest financial capacity should thus take the lead in solving this problem by funding clean-up activities throughout the world (Barnes, 2019; Clift et al., 2019; Fadeeva and Van Berkel, 2021; Verrips et al., 2019).
7. Educate citizens and create more public awareness and change the culture of mass consumption to reduce overall plastic use (statement #13). In many ways, plastics themselves are not the problem, they are durable, efficient, and infinitely adaptable materials (Bucknall, 2020). Rather, the problem resides in the high-paced capitalist system of mass consumption and production that depends on cheap throwaway plastics. The question is thus not only how to better recover and reuse plastics but rather how to use less of everything (Nielsen et al., 2020). Sustainability education and awareness-raising should not focus on individual consumer choices and behaviours, which have very limited environmental impacts (Evans et al., 2020). Instead, it should focus on "questioning our over-consumptive consumerist lifestyles" (Stafford and Jones, 2019) and "challenging entrenched corporate and societal views about growth" (Mah, 2021). It is indeed key to promote post-materialist worldviews, which not only reduce the demand for unnecessary consumption but also open the door to slower, healthier and more convivial ways of life (D'Alisa et al., 2014; Hickel, 2020b; Latouche, 2009).

The above policy recommendations should be understood as a set of integrated policies, which complement each other. Plastic poses complex problems, which cannot be addressed through siloed actions or single strategies. A combination of value retention options from refuse (R0) to remine (R9) are thus needed, along with strong social justice and global solidarity policies. While these recommendations are specifically formulated for the Dutch policy context, they might also bring insights and ideas for the transition to a circular economy in other countries and contexts.

5.4.3 Limitations and future research

The first limitation of this research is the long and complex Q-survey process, which participants sometimes find difficult and overwhelming, thereby explaining the low participation rate (17.8%). This is a known implication of using Q-Methods, and it is an integral part of this methodology, as the long and complex ranking of statements forces each participant to make key choices that reveal their underlying discourse on the topic (Webler et al., 2009). The various pilot tests of our questionnaire in several online Q-method survey platforms helped us choose the most user-friendly option and limit this barrier to participation. However, future research should look at ways to further reduce the complexity of the Q-sorting process, both online and in-person.

Another key limitation of the methods is that the statements of the Q-survey were created from the results of the interviews and the policy and media analysis. They, therefore, replicate hegemonic visions on the CE transition for plastics, meaning that more alternative and radical propositions might not be adequately addressed and represented in the Q-survey. The following policies were therefore missing from the analysis as they were not present in the analysed concourse, yet they might be important elements of the transition:

- Banning unnecessary plastic uses such as potable water bottles and additives in cosmetics and personal health products (Clift et al., 2019; Verrips et al., 2019).
- Supporting local farmer markets and shops rather than supermarkets and online stores, which have more processed and/or packaged goods(Fardet and Rock, 2020).
- Establishing marine protected areas and banning bottom trawling and other harmful industrial fishing activities which devastate ocean biodiversity and are a key source of plastic pollution (Fadeeva and Van Berkel, 2021; Nielsen et al., 2020; Stafford and Jones, 2019).

Future research should further analyse these and other policy options and approaches to addressing the CE transition for plastics.

Another key limitation lies in the very object of the study. Some authors have argued that the recent focus on the plastic pollution problem is a distraction from more urgent and important challenges of climate change and biodiversity conservation (Nielsen et al., 2020; Stafford and Jones, 2019). The art of policymaking can be understood as "creating problems that institutions can handle"(Palm et al., 2021), and, in that regard, the plastic pollution problem can be seen as a perfect opportunity to employ a neoliberal discourse of technocentric, market-based solutions, whereby corporations can resolve the plastic problem with their recycling innovations (Mah, 2021). Results from this research suggest that this technocentric discourse represents a dominant framing of the problem in the Netherlands. Future research in this regard is necessary, especially research that goes beyond a purely technical approach to plastics and looks at the manyfold social and ecological implications of cheap throwaway plastics within a global system of mass consumption and production. Indeed, plastics themselves are hardly the problem; it is rather how they are used by the current socio-technical system which is the problem(Mah, 2021). Plastics are merely a cheap, lightweight, and flexible material, yet this system has used them as a throwaway vehicle that replicates a high-speed cycle of endless mass consumption. This systemic perspective on the topic must be further researched and understood, not only because we cannot grow forever on a finite planet but also because research has shown that human beings aspire for infinitely more meaningful and convivial lives than the productivist materialism on which capitalism depends (Hickel, 2020b; Jackson, 2016; Latouche, 2009).

5.5 Conclusions

This research has found that Dutch policies and discourses on plastics mainly follow a *Technocentric Circular Economy* perspective, which places high hopes on technological innovations such as chemical and mechanical recycling technologies and pays little attention to reducing global socio-ecological impacts. In the short term, this strategy might make the Netherlands appear as a frontrunner in the transition to a CE and thereby bring unprecedented growth to its plastic recovery industry. Yet, considering the many limitations of recycling technologies, it is highly unlikely that such a strategy will effectively reduce the human and environmental health impact of plastics. Instead, higher value retention options, such as refuse (R0), reduce (R1), and reuse (R2) should be prioritised, along with strong social justice policies. Our research proposes key policy recommendations in this regard (section 5.4.2), which are based on a detailed analysis of the current plastic management system in the Netherlands. While these recommendations are specifically formulated for the Dutch policy context, they might also bring valuable insights that can help both practitioners and academics better understand and implement the transition towards a sustainable circular plastics economy in other countries and regions.

All in all, our research has found that the dominant discourse on the CE transition for plastics in the Netherlands assumes that the current system of mass production and consumption can remain unchanged. Next-day deliveries and highly processed foods and products made with components and ingredients from all over the world are thereby set as unchangeable variables. Our research shows that the dominant imaginaries in the Netherlands are not considering alternatives, such as neighbourhood stores and restaurants, repair cooperatives and community-based markets of local, fresh, healthy, and seasonal goods that require little or no packaging in the first place. We observe that the economic interests of plastic industries, online retailers, and ultra-processed foods dominate the material and discursive landscape upon which CE policies are formulated. Therefore, the current plastic discourse in the Netherlands does not challenge the capitalist system of fast-paced mass consumption, which fuels the need for so much plastic in the first place. Moreover, it replicates recycling fairy tales and neoliberal imaginaries of continuous economic growth, which disregard the biophysical limits of earth and the laws of thermodynamics. Under this discourse, our findings suggest that plastic production and consumption will likely increase, leading to significant adverse environmental and human health implications.

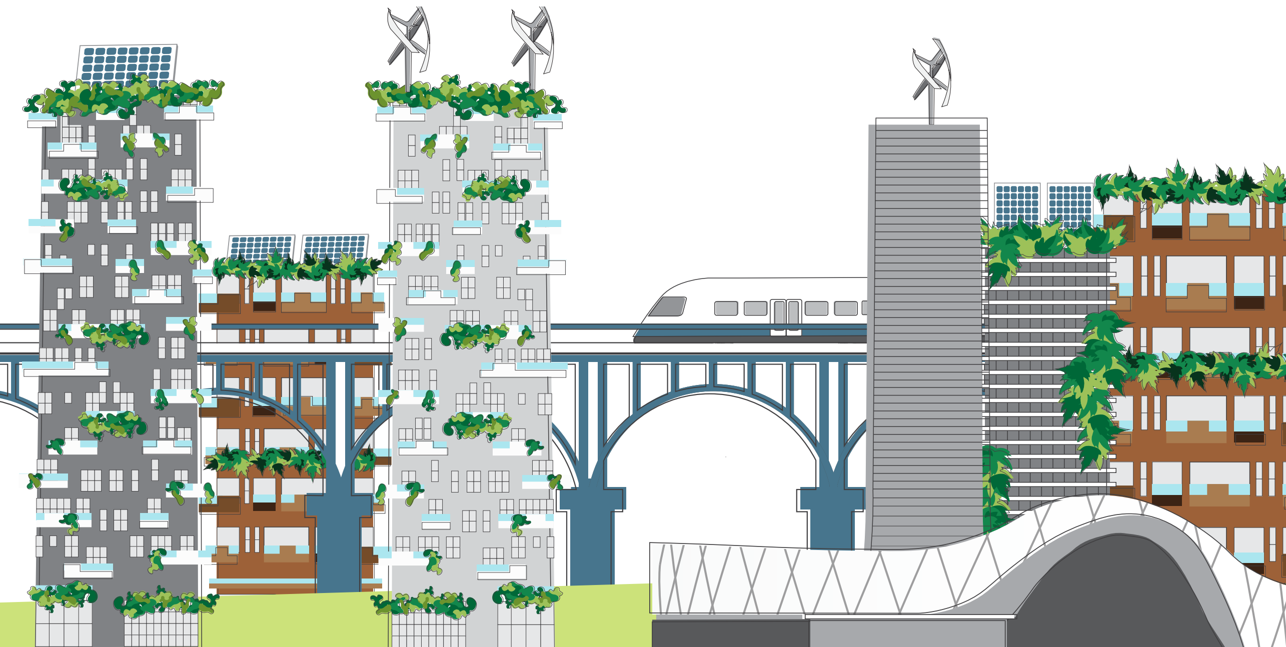
Further critical research on plastic and CE discourses and policies is needed; especially regarding the construction of discursive path dependencies and institutional lock-ins that reinforce a growth-dependent system. Alternative approaches to the plastic problem are needed from a systemic, plural, and transdisciplinary perspective. We hope the insights and recommendations brought by our research help bring light to this important academic and societal debate, and that future research will further explore the manyfold social, environmental, and political implications that the transition to a sustainable circular plastic economy entails.

Chapter 6

Sustainable Circular Cities: Analysing Urban Circular Economy Policies in Amsterdam, Glasgow, and Copenhagen

This chapter is based on a manuscript under review in the journal Local Environment since August 2022. It is openly available online in the Social Science Research Network (SSRN) repository for preprints as: Calisto Friant, M., Reid, K., Boesler, P., Vermeulen, W.J, & Salomone, R., Sustainable Circular Cities: Analysing Urban Circular Economy Policies in Three European Cities. Available at SSRN: https://ssrn.com/abstract=4133478 or http://dx.doi.org/10.2139/ssrn.4133478

A previous version of this research was presented at the 28th International Sustainable Development Research Society (ISDRS) Conference in June 2022, in Stockholm, Sweden.



Abstract

Cities play a central role in the circular economy (CE) as they are important centres of production and consumption responsible for 80% of global GDP. European cities are particularly important due to their position of power in the global economy as major markets, and places of industrial and social innovation. Yet urban CE policies and discourses remain poorly researched and understood. This chapter aims to address this research gap by analysing and comparing the CE policies and discourses in different European cities to draw key insights and recommendations. It does so by first conducting a review of academic literature on urban CE policies to develop a new conceptual framework to analyse CE discourses and policies. This framework is then used to critically analyse and compare the CE policies of three European cities: Glasgow, Amsterdam, and Copenhagen. Results show that technocentric approaches to CE are dominant in the three cities. Moreover, they have rather limited social justice policies for a fair distribution of the costs and benefits of a CE transition. Key policy recommendations to address these shortcomings are thus developed. The insights brought about by this chapter are valuable for both practitioners and academics seeking to improve urban CE policies.

6.1 Introduction

Global consumption rates have increased tenfold in the past 100 years and are expected to triple by 2050 (Haas et al., 2020). This unsustainable use of natural resources is leading to the overshoot of key planetary boundaries and the critical weakening of the life-sustaining functions of the biosphere (Folke et al., 2021; Marín-Beltrán et al., 2022; Wiedmann et al., 2020). The Circular Economy (CE) concept has recently become a central discourse to address those socio-ecological challenges through various resource conservation, and recovery strategies such as refuse, reduce, reuse, remanufacture, refurbish and recycle (Joensuu et al., 2020; McDowall et al., 2017; Reike et al., 2018a; Temesgen et al., 2019). However, the CE concept is still contested, often unclear and ill-defined, thus its practical implementation remains a large societal challenge (D'Amato et al., 2019; Korhonen et al., 2018b; Lazarevic and Valve, 2017). Cities play a crucial role for the CE as they are key centres of resource use and transformation, responsible for around 80% of global GDP (World Bank, 2021). Cities currently consume approximately 80% of global natural resources, produce 50% of global waste, and 75% of greenhouse gas emissions (Williams, 2019). As urban populations are expected to increase in the future, these figures will only continue to grow. Moreover, cities are directly in charge of key sustainability and CE-related policies, such as waste management, water and energy provision, transportation, housing, and industrial development. Urban circular economy policies thus have a key impact on the metabolic stocks and flows of resources, waste, capital, labour, knowledge, energy, and materials that societies process (the so-called Urban metabolism[50]) (Feiferytė-Skirienė and Stasiškienė, 2021; Lucertini and Musco, 2020; Venkata Mohan et al., 2020). Furthermore, cities also face various key socio-economic issues such as income inequality, social injustice, unemployment, financial austerity, and housing shortages (Bassens et al., 2020; Williams, 2021).

European cities are particularly important for CE as they occupy a position of power in the global economy as canters of consumption, capital accumulation and social and industrial innovation. Moreover, European cities are frontrunners in CE implementation, especially since the implementation of the European Union's (EU) 2015 CE action plan (Fratini et al., 2019; Kębłowski et al., 2020; Petit-Boix and Leipold, 2018; Prendeville et al., 2018). European cities will thus strongly influence the overall understanding of the CE and can shape the discourse and future implementation of urban CE policies throughout the whole world. Yet, their diverse and often contrasting CE policies remain poorly researched, compared and understood (Gravagnuolo et al., 2019; Joensuu et al., 2020; Marin and De Meulder, 2018; Paiho et al., 2020; Vanhuyse et al., 2021). This paper seeks to address the above research gap, by asking the following question: *How can urban circularity policies and discourses be critically*

50 Urban metabolism can generally be defined as "the sum total of the technical and socio-economic processes that occur in cities, resulting in growth, production of energy, and elimination of waste" (Castán Broto et al., 2012). The concept of urban metabolism facilitated the analysis of how resources, materials, energy, power, wealth, labour, and knowledge flows within cities, as well as the socio-political structure that governs who controls these flows and how they are distributed (Swyngedouw, 2015).

analysed and compared, and what discourse is advanced by different circular city policies in Europe?

To answer this question this chapter carries out an academic literature review to develop a CE policy-discourse framework, which acts as the analytical tool to explore and compare how CE manifests in different cities. This framework is then applied to 3 case studies in Europe (Glasgow, Copenhagen and Amsterdam) to improve our understanding of CE implementation in urban areas. Results from this research lead to valuable insights on the strengths and limitations of current CE policies in European cities. The discussion section then critically compares our findings to develop key policy recommendations, which can help both academics and practitioners better design and implement CE interventions at the city scale.

6.2 Theoretical and conceptual background

While the use of the term CE as such is rather recent, the theoretical underpinnings of the concept have existed since at least the mid-20th century (Blomsma and Brennan, 2017; Geissdoerfer et al., 2017; Gregson et al., 2015). Indeed, the CE can best be seen as an umbrella concept that includes a variety of different ideas and visions from the global north and south alike (Calisto Friant et al., 2020; Homrich et al., 2018).

CE thinking can be divided into 3 main historical periods (Reike et al., 2018a). Between 1945 and 1980, a plurality of precursors to the CE emerged with publications and ideas such as The Closing Circle (Commoner, 1971), the Limits to Growth (D. Meadows et al., 1972), Steady State Economics (Daly, 1977), the Tragedy of the Commons (Hardin, 1968), Small is Beautiful (Schumacher, 1973), and Post-Scarcity Anarchism (Bookchin, 1971). This period brought the key socio-ecological challenges of the linear industrial system to light and proposed a rich variety of alternatives to our growth-dependent capitalist society

Between the 1980s and 2000, with the rise of neoliberalist economic thinking, new approaches to resource and waste management were created, which focused on technological solutions to close the input and output side of the economy. Innovative approaches to resource-efficiency were thus developed during this period such as Industrial Ecology (Frosch and Gallopoulos, 1989), Reverse Logistics (Rogers and Tibben-Lembke, 1998), Extended Producer Responsibility (Lindhqvist, 2000), Product Service System (Goedkoop et al., 1999) and Biomimicry (Benyus, 1998). These concepts often took inspiration from nature to build technologies and business models that could bring win-win solutions for nature and the economy and thereby decouple economic growth from environmental exploitation.

In the early 2000s, social justice, and participation concerns, which were prevalent in the 1970s were brought back to the discursive stage. Concepts such as Spiral Economy (Ashby et al., 2019), Symbiotic Economy (Delannoy, 2017), Regenerative capitalism (Fullerton, 2015), the Sharing Economy (Frenken, 2017) and the Blue Economy (Pauli, 2010) were thus developed, which built on the technological innovations of the 80s and 90s by adding social elements. During this period more transformational perspectives on circularity also emerged such as Degrowth (Latouche, 2009), Buen Vivir (Gudynas and Acosta, 2011), the Economy for the Common Good (Felber, 2015), Permacircular Economy (Arnsperger and Bourg, 2017), and Ecological Swaraj (Kothari et al., 2014), which were sceptical about the ability of new technologies alone to protect the planet from ecological collapse within the constraints of the capitalist system. They thus challenged the unsustainability of a system based on endless economic growth and saw the need for a wholescale transformation to a post-capitalist society.

To better evaluate, understand, and navigate various CE visions and understandings through history, this research uses the CE discourse typology developed by Calisto Friant et al. (2020). The typology is based on extensive research on CE and its related concepts and has been used in other research to analyse CE discourses in Norway (Hermann and Pansera, 2020; Ortega Alvarado et al., 2021), CE discourses in Australia (Melles, 2021), Dutch CE policies in the plastic sector (Calisto Friant et al., 2022a), urban living labs in the City of Tampere, Finland (Särkilahti et al., 2021), CE policies at the EU level (Calisto Friant et al., 2021), and the EU plastics strategy (Palm et al., 2021).

The typology differentiates CE discourses based on 2 core criteria (see Figure 6.1). First, whether they are **optimist** or **sceptical** regarding the possibility that technological innovation can prevent an ecological collapse by decoupling economic growth from environmental degradation. Second, whether they are **holistic** by integrating the social justice and political empowerment elements in their vision of circularity or **segmented** by focusing on economic aspects of circularity such as new business models and resource-efficiency. The combination of the above criteria leads to four types of circular discourses: Reformist Circular Society (optimist and holistic), Technocentric Circular Economy (optimist and segmented), and Transformational Circular Society (sceptical and holistic), and Fortress Circular Economy (sceptical and segmented). It is important to note, however, that some discourses may include various elements of the four discourse types. For example, a national government may have a prominent Technocentric Circular Economy discourse alongside moderate notes of Reformist Circular Society (Calisto Friant et al., 2020).

In addition to the above circularity discourse typology, it is important to acknowledge the limits and opportunities that cities have in relation to the development and implementation of CE actions and policies. On the one hand, cities are limited due to the territorial and regional contexts in which they are located. They are thus constrained by the policies and regulations established at provincial, national, and international levels such as recycling and greenhouse gas emission targets, property relations, taxation policies, trade and investment treaties, etc. (Castán Broto et al., 2012; Paiho et al., 2020; Savini, 2019) On the other hand, cities are historically spaces of deep political contestation, protest, social change and technological innovation (Fung and Wright, 2001; Harvey, 2012). Cities can thus experiment with policies, strategies and approaches which are often much more politically radical or economically innovative than what is possible at other governance levels.

Technological innovation and ecological collapse		Approach to social, economic, environmental and governance considerations: Holistic	Approach to social, economic, environmental and governance considerations: Segmented
	Optimist	**Reformist Circular Society (RCS)** - **Assumptions**: eco-economic decoupling is possible and social justice and democracy is key for a circularity transition. - **Goal**: human prosperity and well-being within the biophysical boundaries of the earth. - **Means**: Technological breakthroughs and social policies that benefit humanity and natural ecosystems. - **Example concepts**: Natural Capitalism, Cradle to Cradle, The Performance Economy, The Natural Step, The Blue Economy, Regenerative Design. - **Proponents**: international organizations, large foundations and some governments.	**Technocentric Circular Economy (TCE)** - **Assumptions**: eco-economic decoupling is possible and social justice and democracy is not key for a circularity transition. - **Goal**: economic prosperity and development without negative environmental externalities. - **Means**: economic innovations, new business models and unprecedented breakthroughs in CE technologies - **Example concepts**: Industrial Ecology, Reverse Logistics, Biomimicry, Industrial Symbiosis, Cleaner Production, Bioeconomy. - **Proponents**: corporations, some national and city governments, and international organizations.
	Sceptical	**Transformational Circular Society (TCS)** - **Assumptions**: eco-economic decoupling is impossible and social justice and democracy is key for a circularity transition. - **Goals**: A world of conviviality and frugal abundance for all, while fairly distributing the biophysical resources of the earth - **Means**: Complete reconfiguration of the current socio-political system and a shift away from productivist and anthropocentric worldviews. - **Example concepts**: Conviviality, Steady-state economics, Permacircular Economy, Degrowth, Social Ecology, Buddhist Economics, Buen Vivir, Ubuntu. - **Proponents**: social movements, bottom-up circular initiatives, and indigenous movements.	**Fortress Circular Economy (FCE)** - **Assumptions**: eco-economic decoupling is impossible and social justice and democracy is not key for a circularity transition. - **Goal**: maintain geostrategic resource security in global conditions where widespread resource scarcity and human overpopulation cannot provide for all. - **Means**: innovative technologies and business models combined with rationalized resource use and migration and population controls. - **Example concepts**: The tragedy of the Commons, The Population Bomb, Overshoot, Disaster Capitalism, Capitalist Catastrophism. - **Proponents**: Geostrategic think tanks and state policies.

FIGURE 6.1 | Circularity discourse typology (Calisto Friant et al., 2022a).

6.3 Methods

This research was carried out in 4 stages which are presented schematically in Figure 6.2. The first 2 stages build upon the circularity discourse typology to develop a policy-discourse framework which serves as a critical tool to analyse and compare the plurality of CE policies and the associated discourses at the city level. In the third stage, case studies were selected amongst European cities and in the fourth stage, the policy-discourse framework was applied to analyse those case studies.

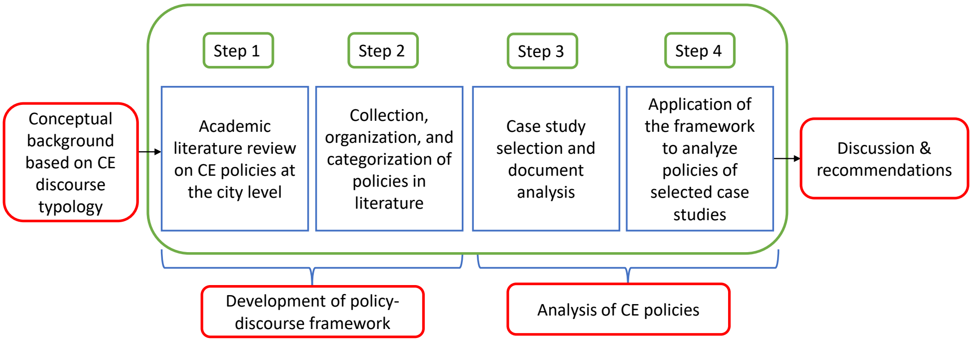


FIGURE 6.2 | Methodological steps.

6.3.1 Step 1: Academic literature review

The first step in building the policy-discourse framework was to conduct a literature review to identify what circular policies at the city level are proposed and discussed in the academic literature. The search for academic articles in this review was based on the circular discourse typology presented earlier (Calisto Friant et al., 2020). This typology found 72 concepts and ideas historically related to CE and divided them into 4 discourse types (see Figure 6.1). We selected 26 of these concepts as keywords for article searches across the 4 circularity discourse types based on relevance and availability of literature relating to urban policies[51]. We thereby reviewed 2 to 6 articles for each concept depending on the number of search results we found on Scopus. Articles were chosen based on their relevance regarding the studied topic, that is, whether they discussed urban policies in their respective conceptual areas. In total, 88 academic articles were thus reviewed (see Table 6.1 and supplementary materials of Calisto Friant et al., (2022b)). All articles were found via Scopus searches, except for Buen Vivir articles as there was a lack of relevant search results on Scopus. Indeed, Scopus has an over-representation of literature in English (Albarillo, 2014; Morrison et al., 2012), yet most literature on the topic of Buen Vivir is in Spanish so it was necessary to complement the results with Google Scholar.

51 The number of concepts chosen for each circularity discourse type was proportional to their prevalence in the CE typology. For example, Calisto Friant et al. (2020) found that the most widespread discourse within academic literature is TCS (42% of reviewed concepts); thus, more TCS concepts were reviewed in this research than TCE (26%), RCS (28%) and FCE (4%) respectively.

TABLE 6.1 | Search terms used to identify the relevant articles.

Discourse type	Concept	No. of Scopus search results on 11/1/2021	No. of articles reviewed
General	Circular Economy	153	17
Reformist Circular Society	Sharing Economy	91	4
	Cradle to cradle	36	3
	Natural Capitalism	6	2
	Regenerative Design	60	3
	Cyclical Economy	3	1
	The Natural Step	4	1
	Material Efficiency	39	2
Technocentric Circular Economy	Industrial Ecology	128	3
	Biomimicry	65	3
	Bioeconomy	64	3
	Industrial Symbiosis	38	2
	Eco-industrial Parks	93	3
	Product Service Systems	12	1
	Cleaner Production	63	3
Transformational circular society	Ecofeminism	28	2
	Deep Ecology	17	2
	Social Ecology	37	2
	Radical pluralism	7	1
	Transition Towns	31	4
	Degrowth	62	6
	Buen Vivir	19	4
	Permaculture	33	3
	Ubuntu	6	1
	Ecological Civilisation	70	3
Fortress Circular Economy	Disaster Capitalism	23	6
	Fortress Europe	10	3

6.3.2 Step 2: Collection, organization, and categorization of policies

The next step involved the careful review of each article and the collection of all the urban circularity policies which they mentioned. This led to an initial list of 114 different policies. These policies were then refined and combined to reduce redundancies and inconsistencies, resulting in a final list of 48 policies. We then divided these into 12 policy areas and 3 policy categories based on the different circularity policy areas we found in the literature (see Table 6.2). Subsequently, the identified policies were assigned to one of the four circularity discourse types based on the extent to which each policy would reflect and reproduce one of the discourses.

TABLE 6.2 | Policy areas identified in the literature review.

Policy category	Policy area	No. of policies	No. of policies per discourse type*			
			TCE	RCS	TCS	FCE
Waste & Material Resource Flows	Renewable Energy	2	1	1	0	0
	Waste Management	6	5	1	0	0
	Water Management	3	2	0	1	0
	Food & Organic Waste Streams	4	1	2	1	0
Built Environment & Spatial Planning	Transport & Mobility	4	1	3	0	0
	Green Buildings	5	2	2	1	0
	Urban Form & Territorial Planning	4	1	1	1	1
	Ecosystems & Nature-Based Solutions	2	0	1	1	0
Socio-political Structure	Economic & Industrial Policy	5	2	0	2	1
	Governance & Municipal Operations	5	3	2	0	0
	Education & Knowledge Development	4	1	2	1	0
	Social Justice & Livelihoods	4	0	1	3	0

*TCE: Technocentric Circular Economy, RCS: Reformist Circular Society, FCE: Fortress Circular Economy, TCS: Transformational Circular Society

6.3.3 Step 3: Case-study selection and document analysis

To select case studies, we first formed an initial sample of circular city cases by searching cities mentioned in academic literature as well as circular city alliances and examples of circular cities mentioned by practitioner organizations such as the Circular City Declaration, the ICLEI Circulars leading circular city list, the Ellen McArthur Foundation (EMF) circular city examples, and the OECD circular city case-studies[52]. This led to an initial list of 48 European cities. Within this set of cities, we searched for those with a CE strategy published at least in 2018 or later. This is key since the CE discourse is continuously evolving, we thus seek to review relatively recent CE policies to ensure our research investigates the present discourse and vision of the topic. This also allows us to avoid redundancies with previously published research on earlier circular city strategies and policies. Due to language restrictions, only cases with policy documents in Portuguese, Spanish, French, Danish, and English were selected. All in all, only Amsterdam, Glasgow, and Copenhagen fit all the above criteria and

52 List of examined circular city initiatives and networks: Circular City Declaration (https://circularcitiesdeclaration.eu/), the C40 Cities list of Circular cities (https://www.c40.org/researches/municipality-led-circular-economy), OECD circular city case-studies (https://www.oecd.org/cfe/regionaldevelopment/circular-economy-cities.htm), the Ellen McArthur Foundation circular city examples (https://ellenmacarthurfoundation.org/topics/cities/examples), the Climate-KIC circular cities project (https://nordic.climate-kic.org/success-stories/circular-cities-project/), EU circular urban agenda members (https://futurium.ec.europa.eu/en/urban-agenda/circular-economy/pages/members), ICLEI Circulars leading circular city list (https://circulars.iclei.org/), Circular City Governance case-studies (https://vlaanderen-circulair.be/circulargovernance/index.html), Circular City Funding Guide case studies (https://www.circularcityfundingguide.eu/case-studies/), EU SHARING project cities stakeholders (https://www.espon.eu/sharing), Circle Economy circular city projects (https://www.circle-economy.com/programmes/cities/services), Zero waste cities best practice list (https://zerowastecities.eu/bestpractice/the-story-of-roubaix/), Carbon Neutral Cities Alliance (https://carbonneutralcities.org/cities/).

were thus selected as case studies for this research[53].

Once the case studies were chosen their CE strategies and associated policy documents were reviewed and analysed to establish a critical understanding of the cities' visions of CE, including their main goals, targets, definitions, assumptions, and governance mechanisms. The policy documents analysed included the main CE action plans or strategies and other associated documents published by the local city governments or their partners in the initiative (see Table 6.3).

TABLE 6.3 | Data sources for policy analysis and policy-discourse framework.

Publisher	Date published	Document
Municipality of Amsterdam	2020	Amsterdam Circular 2020-2025 Strategy
	2020	Amsterdam Circular Monitor
	2020	The Amsterdam City Doughnut: A Tool for Transformative Action
	2020	Amsterdam Circular 2020-2025 Innovation and Implementation Programme (*Innovatie- en Uitvoeringsprogramma)* 2020-2021
Glasgow City Council	2020	Circular Economy Route Map for Glasgow
	2020	Circular Economy Route Map for Glasgow Committee Document
Copenhagen Municipality	2019	Circular Copenhagen: Resource and Waste Management Plan 2024

6.3.4 Step 4 Application of the policy-discourse framework

The policy discourse framework is summarised in table 6.4 (see supplementary materials of Calisto Friant et al., (2022b) for detailed version).

The policy-discourse framework measures the strength of the relationship between the selected cities CE action plans/strategies and one of the four circularity discourse types and the level of commitment each city has to the different policy areas. The strength of the relationship to the discourse type and level of commitment to different policy areas was defined using a scale of 1-5 (Table 6.5).

53 The search for case studies took place from March to April 2021, any circular city policy published after those dates could thus not be considered for this study.

TABLE 6.4 | Summarised policy-discourse framework.

Policy Category	Policy Area	Policy	Discourse type*
Socio-political Structure	Economic and industrial policy	Supporting CE businesses, entrepreneurs, and start-ups.	TCE
		Deregulating to foster innovation and foreign investment.	TCE
		Supporting local cooperatives and the social and solidarity economy.	TCS
		Creating capacity for deindustrialisation and low-tech self-sufficiency.	TCS
	Governance and municipal operations	Shifting public services to the private sector.	FCE
		Creating bottom-up participatory governance.	RCS
		Facilitating collaborative partnerships with private sector.	TCE
		Establishing digital monitoring and evaluation systems.	TCE
		Creating or improving environmental standards.	TCE
		Circular procurement and management of municipal goods and infrastructure.	RCS
	Education and knowledge development	Communication initiatives to encourage resource recovery and recycling.	TCE
		Cultural transformation towards slower, healthier and more convivial ways of life.	TCS
		Training and capacity building to spread CE technical skills and knowledge.	RCS
		Collaborative research and knowledge development on CE.	RCS
	Social justice and livelihoods	Social inclusivity and equality in access to urban infrastructure and services.	TCS
		Housing cooperatives, community housing and social housing.	TCS
		Local currencies and cooperative banking.	TCS
		Supporting sharing economy activities and projects.	RCS
Waste and Material Resource Flows	Renewable energy	Centralised renewable energy production.	TCE
		Decentralised, community-owned renewable energy production.	RCS
	Waste management	Improving waste recovery and recycling infrastructure and technologies.	TCE
		Creating and/or supporting secondary materials market.	TCE
		Economic incentives to reduce non-recyclable waste generation.	TCE
		Fostering urban mining activities (material and energy recovery from landfills).	TCE
		Restricting single-use packaging and encouraging reusable packaging.	RCS
		Promoting industrial and urban symbiosis and establishing eco-industrial parks.	TCE
	Water management	Recovery and recycling of resources from wastewater.	TCE
		Increasing the efficiency of water provision.	TCE
		Establishing progressive incentives to reduce water consumption.	TCS
	Food and organic waste streams	Supporting and promoting urban and peri-urban agriculture.	RCS
		Promoting household and community composting of bio-waste.	TCS
		Establishing centralised bio-waste recycling systems.	TCE
		Reducing food waste and encouraging sustainable diets.	RCS

Policy Category	Policy Area	Policy	Discourse type*
Built Environment and Spatial Planning	Transport and mobility	Improving and encouraging shared mobility (bike-sharing, ridesharing etc.).	RCS
		Improving public transport infrastructure and promoting its use.	RCS
		Improving active transport (walking, cycling) infrastructure and promoting it.	RCS
		Promoting private green transportation technologies (electric cars etc.).	TCE
	Green Buildings	Setting circular construction standards and regulations.	TCE
		Fostering circular recovery of demolition materials.	TCE
		Infrastructure refurbishment, rehabilitation, renovation, and repurposing.	RCS
		Redistributing unused buildings and preventing unfair accumulation of housing.	TCS
		Promoting shared building uses such as shared workspaces and co-housing.	RCS
	Urban form and territorial planning	Construction of private conflict and disaster protection infrastructure.	FCE
		Planning compact multi-functional and convivial neighbourhoods.	RCS
		Building infrastructure for city-wide climate resilience and adaptation.	TCE
		Fostering urban-rural symbiosis and supporting rural livelihoods.	TCS
	Ecosystems and nature-based solutions	Providing and maintaining ecosystem services by creating green infrastructure.	RCS
		Strictly conserving, restoring, and protecting biodiversity to create harmony between social and natural ecosystems.	TCS

*TCE: Technocentric Circular Economy, RCS: Reformist Circular Society, FCE: Fortress Circular Economy, TCS: Transformational Circular Society

TABLE 6.5 | Assessment scale for policy-discourse framework.

Scale	Explanation
0 = The policy is not mentioned in the CE route map/strategy	The city government doesn't mention or address this policy area at all.
1 = The policy just mentioned in the plan or very little action is taken	Policies in the area are mentioned but no specific actions or commitments are taken (for example, a city might mention the importance of renewable energies but have no project to actually improve renewable energy generation) or the actions involve only small research project(s) with no concrete impact on the policy area.
2 = Limited action is taken	One or more limited actions or projects are established but a rather limited impact can be expected from their implementation, and much more could be done in that policy area.
3 = Some action is taken but more could be done	One or more actions and projects are developed, which would have some impact on the target policy area, but they remain limited in many ways.
4 = Strong action is taken	Strong policies are developed and supported by the city government in a consistent manner, yet a few more actions could still be envisaged in this area to be fully effective.
5 = Very strong action is taken	Would entail the city government strongly committing to the respective policy area with impactful actions, regulations, and/or measures that can bring about significant change in the area.

The total number of points available per discourse type and policy area were calculated by multiplying the total number of possible policies in each policy area or discourse type by 5 (the maximum value on the scale). Table 6.6 and 6.7 note the number of policies per discourse type and policy area and the total number of points available. As there are an unequal number of policies per discourse type and per policy area in the framework, the strength of the commitment to the discourse types and different policy areas was calculated as a percentage using the following equations to allow for direct comparison:

TABLE 6.6 | Number of policies per policy area and the total number of points available.

Policy sub-category	Policy area	No. of policies	No. of points available in each policy area
Waste & Material Resource Flows	Renewable Energy	2	10
	Waste Management	6	30
	Water Management	3	15
	Food & Organic Waste Streams	4	20
Built Environment & Spatial Planning	Transport & Mobility	4	20
	Green Buildings	5	25
	Urban Form & Territorial Planning	4	20
	Ecosystems & Nature-Based Solutions	2	10
Socio-political Structure	Economic & Industrial Policy	5	25
	Governance & Municipal Operations	5	25
	Education & Knowledge Development	4	20
	Social Justice & Livelihoods	4	20

TABLE 6.7 | Number of policies per discourse type and total number of points available.

Discourse Type*	No. of policies	No. of points available in each discourse type
TCE	19	95
RCS	16	80
TCS	11	55
FCE	2	10

*TCE: Technocentric Circular Economy, RCS: Reformist Circular Society, FCE: Fortress Circular Economy, TCS: Transformational Circular Society

The abovementioned coding and grading system of the policy-discourse framework was thus applied to all case studies to analyse and critically compare their CE strategies in a systematic and consistent manner. This comparative case study approach allows for a rich and detailed study of the topic (Stewart, 2012) that can be replicated across other contexts and circumstances (Mills et al., 2012). This is key as cities are inherently complex and are formed by a myriad of actors, organisations, and networks (Prendeville et al., 2018). Furthermore, comparative case studies, like this one, are well suited to developing key policy insights and recommendations (Løkke and Sørensen, 2014; Stake, 2005).

6.4 Results

6.4.1 Amsterdam's circularity approach

Amsterdam is the capital of the Netherlands and the country's largest and most populated city. The city is in a central location within the Netherlands for the industry, service, and finance sectors and has the 4th largest port in Europe (Fratini et al., 2019).

In 2016, the Dutch government released the government-wide program 'A Circular Economy in the Netherlands by 2050' intending to reduce the use of primary raw materials by 50% by 2030 and to establish a fully circular economy by 2050 (Government of the Netherlands, 2016). At a local level, Amsterdam developed its first circular action plan in 2012 and its first circular strategy in 2016 (Campbell-Johnston et al., 2019; Fratini et al., 2019). In 2020, the municipal government published its most recent CE policy: the 'Amsterdam Circular Strategy 2020-2025' (Municipality of Amsterdam, 2020a). Amsterdam's CE strategy was developed with the support of Circle Economy and used Kate Raworth's Doughnut Economics as a guiding model (Municipality of Amsterdam, 2020b)[54].

Amsterdam's circular strategy places the transition towards a CE in the context of the ecological crisis and the need for social justice. The strategy acknowledges the socio-ecological impact of the city's unsustainable consumption practices on people and ecosystems in the Global South. It states its overall goal as follows:

> *"Amsterdam desires broad prosperity. By this we mean that material wealth is not the only measure for a good life. It also involves things like wellbeing, sufficient leisure time, good health, a pleasant living environment and space for personal growth. We want to be a modern, thriving and inclusive city for everyone, taking into account the boundaries that the planet imposes on us. Amsterdam is aware of the impact of its consumption and production, both within and far beyond its own city limits."*
>
> (Municipality of Amsterdam, 2020a p17)

Following the doughnut model, the CE is positioned within a framework that fosters social wellbeing within planetary boundaries (Municipality of Amsterdam, 2020c). Thus, at the outset, Amsterdam takes a more holistic definition of the CE which is in line with the RCS discourse. However, within the strategy, there seems to be a contradiction in the

54 The doughnut model proposes a social foundation and ecological ceiling for the planet. The inner ring of the doughnut sets the minimum we need to lead good life and to thrive and includes concerns such as health, housing, social equity, political voice, and income work (Raworth, 2017). The outer ring represents the ecological ceiling and is comprised of nine planetary boundaries developed by Rockström et al. (2009) to define the 'safe operating space for humanity' in relation to the environment. According to the municipality, the doughnut model's representation of the CE shows the interconnected nature of the city and offers a unique perspective of a society that can thrive in a sustainable, safe and equitable way (Municipality of Amsterdam, 2020a).

Municipality's discursive position on economic growth and decoupling. The strategy states that:

> *"Every year, we see more extraction of raw materials, higher energy consumption and increasing greenhouse gas emissions. These trends are in line with the growth of the global economy and population."*
>
> (Municipality of Amsterdam, 2020a p10)

Hence, the municipality clearly links economic growth to the socio-ecological problems of the 21st century. Yet, in another segment, the Municipality notes that decoupling economic growth and environmental pressures will be possible and the way forward to approach these challenges:

> *"All things considered, this is the great challenge for the 21st century: to give ourselves and others a fair chance at a good life, while separating economic growth from the pressure on the environment."*
>
> (Municipality of Amsterdam, 2020a p11)

Despite this clear problematization of the socio-ecological impacts of current consumption and production patterns, the conceptualization of the CE in Amsterdam is predominantly defined as a method of waste prevention, promoting resource efficiency, economic savings, and reducing emissions. The municipality's overarching targets are for Amsterdam to reduce CO_2 emissions by 55% by 2030 and by 95% by 2050, to halve the use of new raw materials by 2030, and to become fully circular by 2050 (Municipality of Amsterdam 2020a). Therefore, only material and energy efficiency goals are measured with clear targets. Regarding societal concerns, there are only broad overarching visions for the future of Amsterdam as a progressive and prosperous city, with no tangible targets to measure their progress in this regard. Nonetheless, it is worth noting that the municipality has acknowledged this limitation and is still in the process of developing a system for modelling social well-being and prosperity (Municipality of Amsterdam, 2020d).

All in all, the discourses used by the Municipality of Amsterdam align with RCS; supporting the idea that one must enable a reformed form of capitalism where eco-economic decoupling is possible, and technological innovations can enhance ecological health, prosperity and wellbeing for all.

6.4.1.1 Circularity policies

Applying the conceptual framework to Amsterdam's CE policies (see sections 6.3.3 and 6.3.4) results show that the strongest actions are taken in the policy areas of governance and municipal operations (72%), education, and knowledge development (65%), food and organic waste streams (70%) and waste management (50%). On the contrary, there is a lack of consideration for nature-based solutions (10%), urban form and territorial planning (10%), renewable energy (10%), and transport and mobility (15%) (see Figure 6.3).

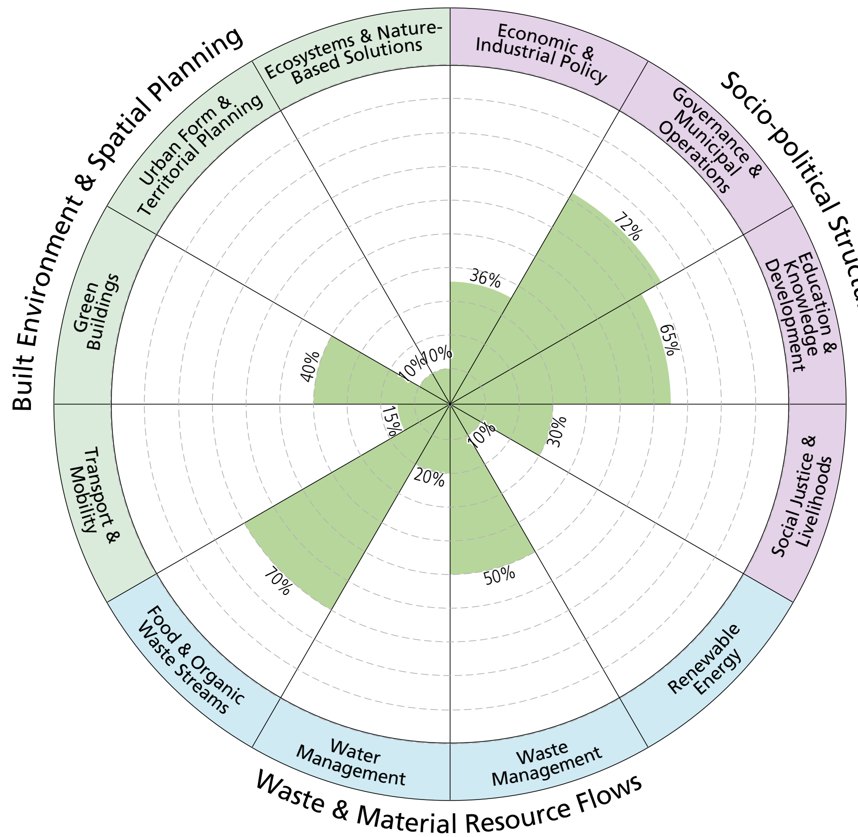


FIGURE 6.3 | Policy areas addressed in Amsterdam's CE strategy.

Waste and material resource flows (44%)

Amsterdam takes strong action in the policy area of ***food and organic waste streams*** *(70%)*. The municipality acts to promote urban agriculture and the consumption of locally grown food by promoting regional food hubs. Moreover, the city aims to encourage both household composting and bio-digestion as well as centralized bio-waste management systems through the deployment of collection containers. The strategy also encourages citizens to shift towards plant-based diets through the Amsterdam Healthy Weight Programme.

The Municipality of Amsterdam is also committed to tackling ***waste management and recycling*** *(50%)*, by improving waste collection and recycling and by fostering the creation of secondary materials markets thanks to digital tools and technologies. The municipality also plans to support urban industrial symbiosis through research programs and experiments and the creation of circular material depots.

Little action is taken concerning ***water management*** *(20%)* and ***renewable energy*** *(10%)* as only small research projects are carried out in those areas on the recovery and recycling of wastewater, the efficiency of water provision in swimming pools and green hydrogen production.

Built environment and spatial planning (21%)

There is a general lack of focus on the built environment and spatial planning. ***Ecosystems and nature-based solutions*** *(10%)* are only included through an experimental food forest project, and in terms of ***urban form and territorial planning*** *(10%)* policies, the municipality is only focused on fostering urban-rural symbiosis through their participation in a European research project. Furthermore, around ***transport and mobility*** *(15%)*, the municipality is only supporting the circular construction of an extension to the north-south railway line. Commitments in the area of ***green buildings*** *(40%)* are stronger, with policies to improve the environmental performance standards of buildings by working with developers and other municipal partners to establish minimum circularity and sustainability requirements such as adaptive design, modular construction, and reduced energy consumption. Furthermore, the Municipality of Amsterdam has many pilot projects, on the circular recovery of demolition waste and on the repurposing and renovation of old buildings and infrastructure to increase material and energy efficiency. With these policies, Amsterdam seeks that by 2025, 50% of all building renovation and maintenance activities follow principles of circular construction.

Socio-political structure (51%)

The municipality is most committed to policies regarding ***governance and municipal operations*** *(72%)*. It is establishing and participating in over 20 public-private partnerships to improve circular innovations in various economic sectors. The municipality also places a significant focus on circular public procurement and public infrastructure as a way to encourage businesses to adopt more circular models. With these policies, the city is aiming for 100% circular procurement and a 20% reduction in public consumption by 2030. Furthermore, the city is creating a monitoring and evaluating system and a data platform to investigate waste streams throughout the city. Amsterdam also has a few participatory projects to obtain residents' perspectives to make some neighbourhoods more circular. In terms of ***education and knowledge development*** *(65%)* policies, the municipality is engaging in many communication initiatives to raise awareness of circularity and change behaviours, particularly regarding sustainable diets and the sharing of goods. Furthermore, the municipality is supporting projects to reskill and educate citizens on the CE and is working with universities and research facilities to carry out various research projects and urban living labs.

Concerning ***economic and industrial*** *(36%)* policies, the municipality supports CE initiatives and start-ups with a plethora of research programs to develop and assess technological innovations for the CE transition. The municipality also supports deregulation and liberalization to support innovation and foreign investment in new CE initiatives. Moreover, the strategy promotes the local production and consumption of goods through initiatives such as Amsterdam Made. Lastly, in terms of ***social justice and livelihoods*** *(30%)* policies, the municipality predominantly focused on promoting sharing economy activities by establishing a circular second-hand depot and training facility to make sharing more accessible. Beyond the sharing economy, however, there is no substantial commitment to fostering inclusivity and social justice and only a small research project is being carried out on community land trusts (see supplementary materials of Calisto Friant et *al.* (2022b) for further details on all the circularity policies established by the city of Amsterdam).

6.4.1.2 Policy-discourse type

Overall, based on the policies proposed within the CE strategy, Amsterdam is aligned with both the TCE (51.58%) and RCS (45%) discourses (Figure 6.4), indicating a strong level of optimism about the role of technological innovation in preventing economic collapse and some concern for the integration of social justice elements into its CE transition.

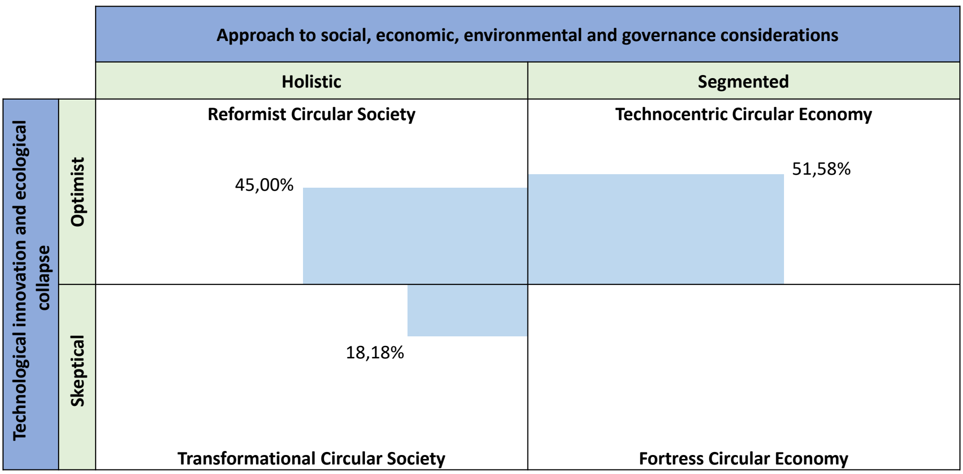


FIGURE 6.4 | Presence of the four circularity discourse types in Amsterdam.

6.4.2 Glasgow's circularity approach

Glasgow is Scotland's largest and most populated city with diverse sectors relevant to the CE such as retail, financial services, engineering, manufacturing, and digital technology (Invest Glasgow, n.d.).

CE policy in Scotland was first set out in the 'Making Things Last' strategy in 2016 to develop a comprehensive approach to extended producer responsibility and to address and expose the costs of recycling and disposal in the region (Scottish Government, 2016). Overall, the CE strategy in Scotland is heavily focused on the management of material and resource flows (Scottish Government, 2016). Within Glasgow, the transition towards a CE first began in 2016, when the Glasgow Chamber of Commerce (GCC), Zero Waste Scotland, and the Glasgow City Council published 'Circular Glasgow' (GCC, 2019). This laid the groundwork for the creation of Glasgow's CE route map, which was designed and published by Glasgow City Council in October 2020 (Glasgow City Council, 2020a).

The city of Glasgow situates the transition to a CE within the context of various overlapping and complex social and environmental problems. The city council provides an extensive critique of the current linear system noting that:

> "*the forty year globalised neo-liberal project to reduce government, the chronic depletion of essential public services throughout the UK, to prioritise GDP, and promote consumer capitalism has presented us with a set of disastrous outcomes.*"
>
> (Glasgow City Council, 2020a, p16)

Neoliberal capitalism is thus seen as the source of various socio-ecological challenges such as inequality, poverty, and climate change (Glasgow City Council, 2020a). The COVID-19 pandemic has, according to the council, highlighted the fragility of hyper-globalization and its complex international supply chains, and the need to return to a more localized and equitable economic system (Glasgow City Council, 2020b). Hence, the City Council intends a vision for the CE route map aiming to…

> "*…promote a message of considered consumption and provide a challenge to the current wasteful consumerist practices(…)*".
>
> (Glasgow City Council, 2020b, p2)

To change consumption practices, according to the council, there must be a paradigm shift in consumer culture and a large commitment to changing working practices and business models (Glasgow City Council, 2020a). Moreover, The City Council sees the need to address deprivation and social exclusion as a key element in the transition to a CE (Glasgow City Council, 2020a).

The Council defines the CE according to the concept of Cradle to Cradle (C2C) which is based on the idea of "the economy being restorative and regenerative – that is, economic activities should strengthen rather than break down social and environmental resources" (McDonough & Braungart, 2002 cited in Glasgow City Council 2020a). Moreover, while benefiting the environment, the City Council notes that the CE will also support job creation and provide economic opportunities for deprived and unemployed communities (Glasgow City Council, 2020a). The Glasgow City Council also follows the Ellen MacArthur Foundation's understanding of CE (which echoes C2C rhetoric), noting that the transition towards a CE should take a systemic approach to economic development, benefitting the environment, society, and businesses and lead to the gradual decoupling of economic growth from resource consumption (Glasgow City Council, 2020a).

Overall, Glasgow's CE route map shows a strong awareness of the socio-environmental impacts related to the overconsumption of resources and the overshoot of ecological boundaries. Moreover, it gives key importance to issues of social justice, fairness, and equity. However, it does not view the CE transition as a way to radically transform its economic and political system beyond capitalism, but rather to stimulate change within the boundaries of capitalism by transitioning away from its dominant neoliberal form. It thereby seeks strong social, technical and economic innovations that enable eco-economic decoupling. Glasgow City Council's understanding of the CE is, hence very much in line with the RCS discourse type.

6.4.2.1 Circularity policies

Applying the conceptual framework to Glasgows's CE route map (see sections 6.3.3 and 6.3.4) demonstrate that the main policy actions are taken in the areas of education and knowledge development (75%), governance and municipal operations (72%) and transport and mobility (45%). The policy areas least explored within Glasgow's CE route map are water management (0%), urban form and territorial planning (10%), and social justice and livelihoods (15%) (Figure 6.5).

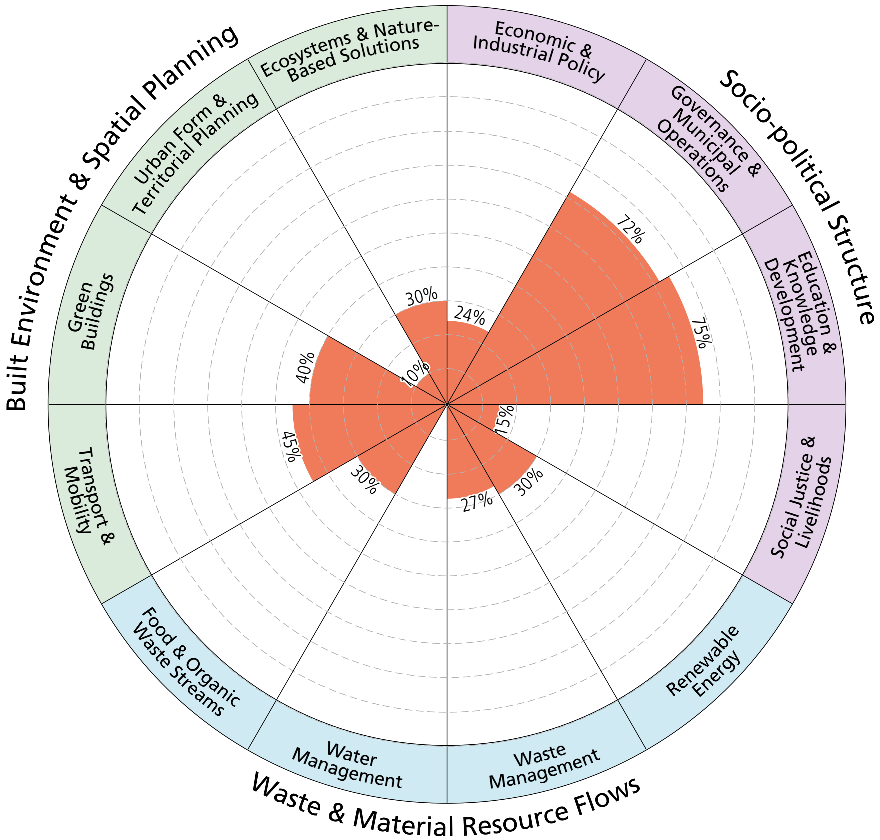


FIGURE 6.5 | Policy areas addressed within Glasgow's CE route map.

Waste and material resource flows

There is a minimal level of commitment from Glasgow City Council concerning waste and material resource flow policies. There are no ***water management*** *(0%)* policies included in the CE route map, however, there are several ***waste management*** *(27%)* policies. For instance, Glasgow City Council is highly committed to supporting the creation of a secondary materials market. To do so, it is creating a municipal material passport that would help coordinate and catalogue all materials in construction projects in Glasgow. Moreover, the Glasgow City Council is creating a virtual business exchange platform to match up waste streams and material inputs as well as an online material-sharing hub to connect citizens and organisations.

Within ***food and organic waste stream*** *(30%)* policies, Glasgow City Council is running city-wide schemes to support businesses using sustainable, healthy, plant-based, low-carbon, and local produce. Through the Glasgow food growing strategy, the council is also helping citizens gain access to community growth opportunities including land, allotments, and financial resources.

In terms of ***renewable energy*** *(30%)*, Glasgow City Council is supporting decentralized renewable energy production and explores opportunities to establish local and district heating networks and assist the uptake of community energy projects.

Built environment and spatial planning

Within the ***transport and mobility*** *(45%)* policy area, the city council is expanding the current bike and electric car hire services, widening pavements for pedestrians, expanding bike lanes, supporting the Glasgow metro initiative to improve public transport infrastructure, and even exploring the possibility of developing a public transport system that is free of charge. Within ***urban form and territorial planning*** *(10%)*, the city council wants to create a 20-minute city through its Liveable Neighbourhoods program. However, progress is in its early stages and is, thus far, relying on change being driven by and within communities.

In terms of ***green buildings*** *(40%),* Glasgow City Council seeks to upscale the adoption of circular construction techniques such as modular construction and design for disassembly. It is also encouraging the retrofitting, rehabilitation, and renovation of buildings to improve energy and resource efficiency and aims to repurpose vacant council units to create incubator co-working facilities for circular businesses.

Lastly, with ***ecosystems and nature-based solutions*** *(30%)* policies, Glasgow City Council is looking to open-up unused vacant land to provide more green spaces in the city and make room for community gardening.

Socio-political structure

In terms of ***social justice and livelihood*** *(15%)* policies, the council focuses on promoting sharing and repair activities, predominantly through partnerships and pilot projects with local CSOs, repair networks and second-hand stores.

Glasgow City Council is committed to various ***governance and municipal operations*** *(72%)* policies. For example, the City Council is prioritizing circular practices, business models, and eco-design within its procurement and tender processes and is working to make local schools and clinics and hospitals more circular. Furthermore, Glasgow City Council is also participating in various public-private partnerships and is collaborating and connecting with other circular cities around the world to share findings, insights and innovations. In terms of creating or improving environmental standards, the city council has established a low-emissions zone for vehicles. Moreover, the city is engaged in various monitoring schemes to better evaluate waste streams and establish social and ecological boundaries. Similarly, Glasgow City Council is committed to various ***education and knowledge development*** *(75%)* policies, for example, they are working to implement a CE communications strategy to influence consumer behaviour and promote the reuse, repair, and sharing of goods. Moreover, Glasgow City Council is a partner in various reskilling and upskilling programs to promote capacity building and knowledge development and has embedded teaching on the CE within nursery and primary school curriculums. Lastly, with ***economic and industrial*** *(24%)* policies, Glasgow City Council has discussed various ideas within the CE route map, however, only a few are carried out in practice. For example, the city council is supporting circular innovation and start-ups by establishing a circular Kickstarter fund, which will provide financial resources and support knowledge development, give rent reductions, and create the possibility of occupying vacant council buildings free of charge (see supplementary materials of Calisto Friant et al., (2022b) for further details on all the circularity policies established by the city of Glasgow).

6.4.2.2 Policy-discourse type

Overall, based upon the policies proposed within the CE route map, Glasgow is most strongly aligned with the RCS discourse (60%) and is to some degree aligned with the TCE discourse (35.79%), indicating a high level of optimism about the role of technological innovation in preventing economic collapse and a relatively strong inclusion of socio-political concerns within its CE policies (Figure 6.6).

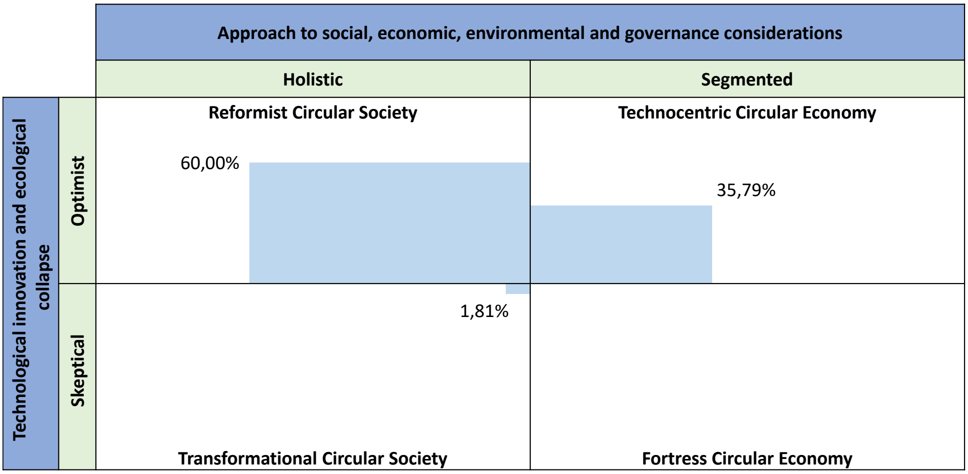


FIGURE 6.6 | Presence of the four circularity discourse types in Glasgow.

6.4.3 Copenhagen's circularity approach

Copenhagen is the capital of Denmark and the country's cultural, economic, and governmental centre. Copenhagen is one of the major financial centres of Northern Europe (Krogh Jensen, 2019) and the city's industry is mainly focused on the service sector with a strong focus on information technology, pharmaceuticals, and clean technology (Dansk Erhverv, n.d.).

In Denmark, the concept of the circular economy rose to prominence in 2015, when the Ellen MacArthur Foundation conducted a case study on circular economy policymaking and its opportunities in the country (EMF, 2015). In 2018, based on recommendations of various Danish CEOs, the Danish government launched its "Strategy for Circular Economy". Overall, the CE strategy in Denmark is heavily focused on promoting 'green growth', increasing resource productivity, and waste prevention (Advisory Board for CE, 2017; Ministry of Environment and Food of Denmark, 2018). Based on its 'Resource and Waste Management Plan 2018', the City of Copenhagen launched its first circular strategy in 2019 termed 'Circular Copenhagen: Resource and Waste Management Plan 2024' (Municipality of Copenhagen, 2019).

The socio-ecological problems that the Municipality of Copenhagen aims to address with its CE plan are not explored in detail. Yet, the preface of the plan states that:

> *"Denmark and Copenhagen are ranked twice as high as the EU average when it comes to resource consumption per capita. This means that we use enormous amounts of raw materials and energy to produce a lot of products that end up as waste far too fast. It also means that in reality, we take more from the Earth than most people. And it means that we lose resources that we could have used."*
>
> (Municipality of Copenhagen 2019, p5)

The municipality acknowledges the issue of over-proportional and unsustainable resource consumption and, indirectly, the Danish people's above-average contribution to excess resource extraction. However, consumption in itself is not regarded as an overarching problem but rather the fact that consumption waste is not properly cycled back into the economy.

The subtitle to the CE Plan: 'Resource and Waste Management Plan', already indicates the municipality's strong focus on wastes and resources which becomes also clear in the municipality's stated main aim:

> *"to give the option to all Copenhageners to act in a resource-aware manner, turning it into a natural everyday habit. The Plan will make it possible to sort your waste at source (…) [and] to make it easier to choose products that are made from e.g. recycled resources"*
>
> (Municipality of Copenhagen 2019, p5)

Generally, the CE plan does not address issues such as environmental justice, resource scarcity, or otherwise engages in critical discussions on overconsumption and its implications for the planet, nature, and human livelihoods. Instead, it focuses on the improvement of recycling and reuse schemes to foster resource efficiency and reduce CO2 emissions.

The municipality of Copenhagen defines the CE in opposition to the linear economy and identifies CE as an integral part of its carbon neutrality strategy, stating that:

> *"materials can circulate for decades and centuries - and thanks to renewable energy this can happen without emitting more CO2."*
>
> (Municipality of Copenhagen 2019, p6)

While decoupling as a concept is not mentioned in the plan, the plan regularly advocates its contribution to carbon neutrality and the CE's opportunities for 'green growth'. Overall, the plan introduces three measurable targets which include the recycling of 70% of household and light industrial and commercial waste, the reduction of 59,000 tonnes of CO2, and a tripling in the number of reused items.

6

Due to a complete omission of social implications of CE and an optimist approach towards 'green growth' with a focus on technological innovation, Copenhagen's CE plan falls clearly within the TCE discourse type.

6.4.3.1 Circularity policies

Applying the conceptual framework to Copenhagen's circular strategy CE (see sections 6.3.3 and 6.3.4) demonstrates that the city takes a rather limited action in all 12 policy areas (Figure 6.7). The main policy areas addressed by Copenhagen are waste management (27%), education and knowledge development (27%), and governance and municipal operations (24%).

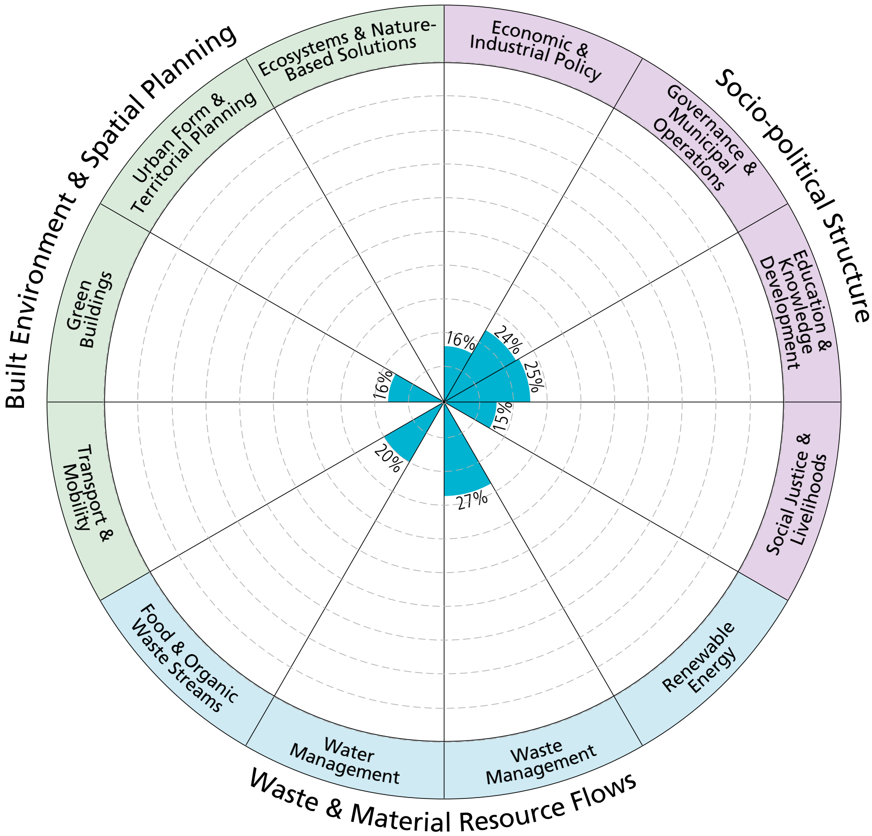


FIGURE 6.7 | Policy areas addressed within Copenhagen's CE plan.

Waste and material resource flows

Overall, Copenhagen's CE plan has a strong focus on waste management and resource efficiency. Within ***waste management and recycling*** *(27%)*, Copenhagen dedicates 13 policies (out of 28 policies in its entire action plan) to improve the separation, collection, processing, and recycling of waste. Concerning industrial symbiosis, the municipality proposes one concrete option for recycling nappies in collaboration with nursery homes, elderly homes, and other businesses. Overall, the measures show a very limited focus on industrial ecology and a strong focus on improving recycling schemes. The Municipality of Copenhagen is also to some extent involved in improving ***food and organic waste streams*** *(20%)*, intending to establish a biogas plant to produce natural gas and fertilizers to enhance organic waste management structures in the city. The plan does not contain policies in the areas of **water management** *(0%)* and ***renewable energy*** *(0%)*.

6

Built environment and spatial planning

In the CE plan, there is a general lack of policies in the built environment and spatial planning. Only in the policy area of ***green buildings*** *(16%)* are measures proposed. The plan aims to improve the recycling and reuse of construction materials by assisting developers in the demolition process and by creating a storage facility for acquiring usable materials that have recently been recovered from old municipal buildings. Moreover, the municipality plans to set the reuse of construction materials as a criterion in tender documents. All measures show a strong focus on recycling and recovering building materials. Copenhagen has no policy measures in the areas of ***ecosystems and nature-based solutions*** *(0%)*, ***transport and mobility*** *(0%)*, and ***urban form and territorial planning*** *(0%)*.

Socio-political structure

Copenhagen is most strongly committed to policies concerning the socio-political structure. In terms of ***social justice and livelihood*** *(15%)* policies, the municipality wants to promote sharing economy activities by aiming to provide and support the establishment of resident-operated repair and workshop facilities. Moreover, Copenhagen Municipality aims to support the development of swap options. Overall, the initiatives focus more on resource utilization than on solidarity, yet the local recycling facilities can function as a tool for community-building. In the policy area of ***governance and municipal operations*** *(24%)*, Copenhagen wants to promote public-private partnerships and stakeholder collaboration aiming to create new solutions to increase the quality of materials circulating within the economy and to specifically recycle higher-quality plastics. Concerning ***education and knowledge development*** *(25%)*, the city aims to educate Copenhagen's citizens on recycling and increase their motivation for sorting. The municipality additionally promotes the labelling of circular products with information on product repairability and recyclability, however, no clear implementation scheme exists for this yet. Regarding ***economic and industrial*** *(16%)* policies, the municipality plans to establish a 'resource lab' and an 'innovation platform'. Both facilities are geared toward developing new business concepts within the recycling and resource efficiency sectors (see supplementary materials of Calisto Friant et al., (2022b) for further details on all the circularity policies established by the city of Copenhagen).

6.4.3.2 Policy-discourse type

Overall, based on the policies proposed within the CE plan, Copenhagen is most strongly aligned with the TCE discourse (30.52%) and marginally with the RCS discourse (6.25%), indicating a strong level of optimism about the role of technological innovation in preventing economic collapse and little to no focus on socio-political concerns (Figure 6.8)

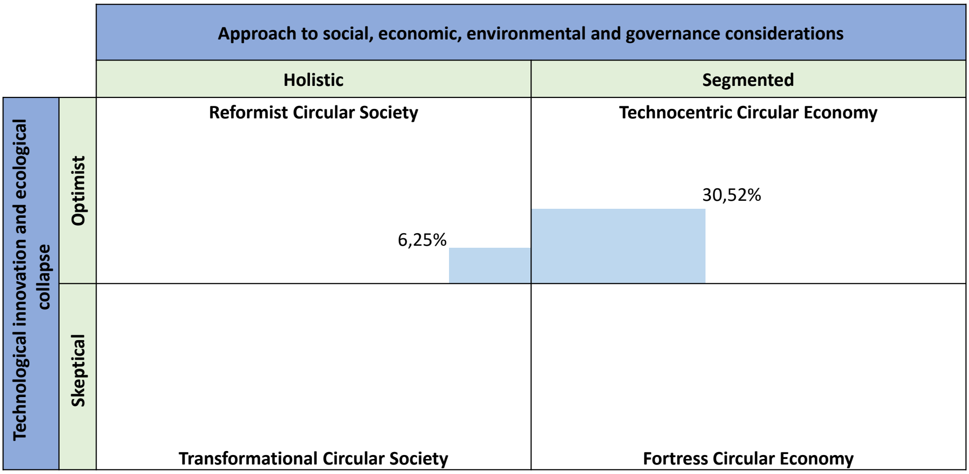


FIGURE 6.8 | Presence of the four circularity discourse types in Copenhagen.

6.5 Discussion

6.5.1 Comparative analysis

Our results demonstrate that RCS and TCE discourses dominate in Amsterdam's and Glasgow's CE policies whereas TCE discourses alone dominate in Copenhagen. They also show that our case studies have overwhelmingly focused on policies related to economic and industrial policy, governance, waste management, green buildings, food, and education, while other policy areas were seldomly addressed such as ecosystems, social justice, and urban form and territorial planning (Figure 6.9).

Our findings for Amsterdam are largely in line with those of previous research in the area. For instance, Maldini (2021), found that, while Amsterdam Circular 2020-2025 Strategy's discourse is quite holistic and progressive, its implementation is "incipient and limited" as it does not include any explicit measures and targets to reduce citizens' overconsumption in a socially equitable manner. Cramer (2020a, 2020b) analysed Amsterdam's previous CE programme (implemented from 2015 to 2019), concluding that it only brings about preliminary progress towards CE as it fails to challenge sector behaviours or product chains. Savini (2021a, 2019) looked at the Amsterdam city-region's waste markets from 2000 to 2019 finding that Amsterdam promotes a contradictory approach to the CE where attempts to reduce consumption are undermined by the expansion of waste recovery infrastructures that necessitate constant inputs of waste. Campbell-Johnston et al., (2019) and Fratini et al. (2019) also have similar results regarding Amsterdam's previous CE strategy, finding that the discursive depiction of the CE as a transformative social strategy is not mirrored in actual policies which continue to prioritise end-of-pipe value retention strategies (e.g., recycling).

All the above research on Amsterdam strengthens our results, which also revealed that Amsterdam's discourse on CE is rather holistic on paper but lacks more transformative social actions that go beyond its focus on economic growth and competitiveness.

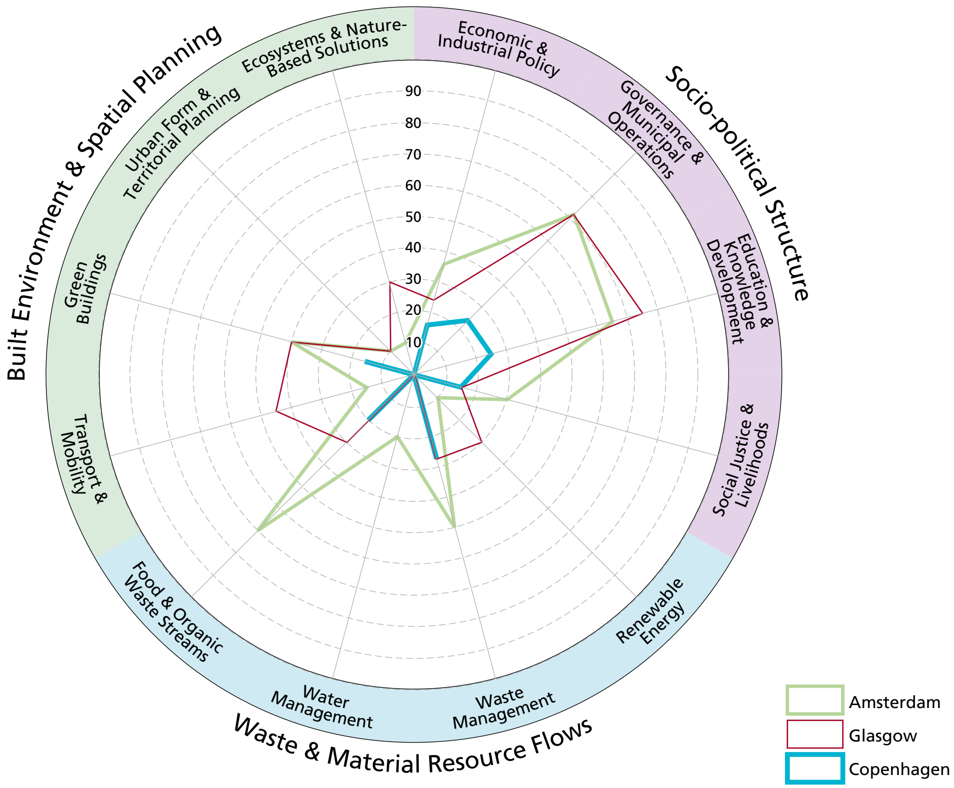


FIGURE 6.9 | Comparative visualisation of the policy areas addressed in the three cities' CE strategies.

Compared to Amsterdam, there is still little scientific literature published on Glasgow's and Copenhagen's CE strategies. Prendeville et al. (2018) have analyzed the previous 2016 'Circular Glasgow' strategy, finding that the city took a rather contradictory approach by being business-centric in its policies while simultaneously offering the possibilities of "being really radical" in its vision of social justice and ecological transformation (p.186). This aligns with our analysis of the 2020 route map, which strongly criticised the impacts of neoliberal capitalism, yet sought market-based innovations and green growth as a solution to those problems.

Krähmer (2021) analyzed Copenhagen's climate, and sustainability plans and strategies published between 2012 and 2016. His analysis of those older sustainability policies evidenced that eco-economic decoupling also played a central role, assuming that it will enhance growth while reducing carbon emissions (Krähmer, 2021). This shows that Copenhagen has been following a technocentric "green growth" approach for some time now, which, as our research revealed, is just reiterated in its latest CE policies.

6.5.2 Technological optimism and the limits to growth

Amsterdam, Copenhagen and Glasgow pursue economic growth as a positive societal goal and objective. All cities thereby assume that, with the transition to a CE, economic growth can be decoupled from environmental degradation. This is reflective of our case study's alignment to the *optimist* RCS and TCE discourse types. However, the assumption that eco-economic decoupling is possible is problematic as decades of scientific literature have found that absolute decoupling is, in fact, impossible and incompatible with wider circularity and climate ambitions (Haberl et al., 2017; Hickel and Kallis, 2019; Jackson, 2016; Parrique et al., 2019; Wiedenhofer et al., 2020). Indeed, economic growth is intrisically tied to energy and material consumption and recycling and recovery technologies can only supply a fraction of necessary raw materials in a continuously growing economy (Giampietro, 2019; Marín-Beltrán et al., 2022; Skene, 2018). By leaving economic growth unquestioned, our case studies fail to address the origins of the socio-ecological issues they want to deal with (Genovese and Pansera, 2020; Giampietro and Funtowicz, 2020; Hobson and Lynch, 2016).

Moreover, the economic growth and competitiveness approach chosen by our three case studies will lead to the development and consolidation of waste management start-ups and businesses. This can create infrastructural lock-ins and path dependencies whereby a city's industry and economy becomes dependent on the continuous outflow of waste (Savini, 2019). In fact, the waste management industry operates on very low margins, so in order to be competitive, it requires substantial investments in infrastructure as well as an abundant and steady stream of waste to create economies of scale (Savini, 2021a). The three case studies in this research could thereby end up depending on continuous resource consumption and extraction to fuel their new waste management and valorisation industries.

All in all, the growth optimist discourse and policies chosen by Amsterdam, Copenhagen and Glasgow are deeply problematic from a sustainability point of view. The economic development of these cities will undoubtedly necessitate large amounts of raw materials and thereby exacerbate socio-ecological impacts throughout the globe (Marín-Beltrán et al., 2022; Martinez-Alier, 2021b). To address these issues, public policies should focus on reducing consumption rather than simply recovering waste (Calisto Friant et al., 2021; Genovese and Pansera, 2020; Reike et al., 2018a). This can be done by fostering socio-cultural change to encourage a transition to more sustainable, slower, and more convivial ways of life. International market competition, globalized capitalist culture, advertisements, and competitive education and employment systems create and reinforce materialist, individualist and consumerist lifestyles (Hickel, 2021; Jackson, 2021; Latouche, 2009). Research has found that this hypercompetitive and hyperconsumerist culture not only has adverse impacts on human health, happiness and wellbeing but also on the planet as it fuels the incessant need for needless material consumption (Büchs and Koch, 2019; Fanning and O'Neill, 2019; Jackson, 2016; Verma, 2017; Vita et al., 2020). Cities should thus establish policies that encourage a transformation to healthier and more sustainable ways of life, such as bans and restrictions on advertisements, especially in public areas, establishing environmental education programs in schools, promoting community ethics through cultural programmes, and creating community-owned media sources (Haluza-DeLay and Berezan, 2013; Poland et al., 2019; Sitas, 2020; White, 2008; Zwiers et al., 2020).

6.5.3 Social justice and transformation

Some social policies have been developed by Amsterdam and Glasgow; however, they have mainly been carried out through a reformist and growth-dependent approach which limits their transformative potential. Societal concerns are not addressed through the redistribution of wealth, property, and resources, but rather, through specific social projects and investments such as the promotion of sharing economies or building retrofits to reduce energy bills. By not distributing wealth, power, and property away from those that overshoot their fair share of planetary resources and towards those that undershoot their fair share, those cities do not fundamentally change unequal societal relations. Instead, they merely address some of the social externalities of a deeply unequal linear system. Moreover, by focusing on specific projects rather than deeper redistribution of wealth, these policies become dependent on future economic growth and development to obtain funding and resources (Savini, 2021b). This ties social policies to the pursuit of economic growth, which has negative ecological implications, as we saw in the above section.

It is also interesting to note that, while Amsterdam and Glasgow acknowledge their dominant position as large centres of consumption and capital replication and accumulation in the Global North; their policies hardly do anything to reduce the impact this has on the Global South. Their constant need for material and energy resources and their position of power in the global economy is therefore not addressed with concrete actions. The policies of these cities thus don't live up to the socially progressive vision they set for themselves. Amsterdam is often presented as a pioneer and an example of best practice in the urban CE transition and Circular Glasgow was a finalist of the Circulars Award of the World Economic Forum (Cuomo et al., 2020; Maldini, 2021; Williams, 2021). Both cities have thus built up a strong reputation as CE innovators which further enhances the competitiveness of their CE business sector while taking limited tangible actions to fundamentally transform their production and consumption systems.

Nonetheless, it is worth adding that the CE action plans of our case studies are in their early stages. Some concrete social policies are still being designed and developed through research activities, pilot projects, and collaborative experiments. In the future, these projects may lead to stronger actions, than what present policy documents suggest. It is however rather unlikely that they will take a radically different approach from what we have evidenced through this research.

To reinforce social justice policies related to CE, these cities could develop stronger actions to circulate money, power, and wealth throughout the local economy in democratic and redistributive manners. This can be done by creating and fostering non-profit cooperative production, banking and housing systems (the so-called social and solidarity economy) and supporting them with sustainable municipal public procurement strategies (Crabtree, 2006; Delgado Ramos, 2015; Escobar, 2019; Korsunsky, 2019; Latouche, 2016; Savini, 2021b; White, 2008). This approach has been implemented with positive social and environmental outcomes notably in Preston (UK) and Cleveland (USA) (Manley and Aiken, 2020; McInroy, 2018; Roberts, 2017; Song, 2016; Sutton, 2019). Cooperatives are directly co-owned and co-managed by workers, communities and/or consumers themselves. They thereby foster democratic citizen control over the economy and create more resilient, vibrant, and self-sufficient local economies (Alexander, 2015; Bookchin, 1982; Felber, 2015). By supporting local cooperatives, municipalities can not only maintain wealth and resources within the local economy, but can also promote and finance ecologically sustainable initiatives such as repair cafés, tool libraries, community swap centres, community-owned renewable energy generation, and community-supported organic agriculture (Hobson, 2019; Hobson and Lynch, 2016; Koretskaya and Feola, 2020; Lekan et al., 2021; Morrow and Davies, 2021). Moreover, cooperatives enable a redistribution of resources, land, wealth, and knowledge, from private corporations to local communities thanks to open-source platforms, community land trusts, local currencies, community banking and other key elements of cooperative and collective ownership structures (Bengtsson et al., 2018; D'Alisa and Kallis, 2020; Ferreira and von Schönfeld, 2020; Foramitti et al., 2020; Gerber and Gerber, 2017). All in all, cooperatives can set the foundations for a democratic economy and enable a fairer distribution of the costs and benefits of a circularity transition.

6.5.4 Participatory democracy

The policies of Glasgow, Amsterdam and Copenhagen lacked substantial participatory processes and commitments in their CE policies beyond public-private partnerships with industrial and economic actors. While Amsterdam is the only case study that had a number of participatory workshops in the development of its CE action plan, these were rather used as consultation processes as the final decisions regarding CE policies remained in the hands of the Municipal government. By excluding citizens from meaningfully participating in the creation of the respective CE strategies, and failing to implement participatory governance mechanisms more broadly, different viewpoints and perspectives are missed out on, limiting the government's ability to identify and explore radically different futures. Through recognising and exploring the diversity in circularity thinking and visions, a greater range of policies and ideas can come to the forefront to address the plethora of socio-ecological challenges that cities face. This democratic diversity and pluralism can not only lead to more appropriate and effective solutions and policies for each city, but it can also improve citizens' commitments to the necessary transformations towards slower and more sustainable consumption practices.

More generally, in Amsterdam, Glasgow and Copenhagen, there is also a lack of discussion concerning who is controlling and governing the CE transition. For example, who owns the technologies and innovations that are being created? Who controls the resource and material flows in the city? What are the implications of these processes? This is problematic as the transition to a CE, if carried out incorrectly, may reinforce or exacerbate current power dynamics and inequalities in cities, benefitting some and disadvantaging others (Genovese and Pansera, 2020; Hobson and Lynch, 2016; Moreau et al., 2017). For example, prosperous neighbourhoods are more likely to benefit from sustainable projects like green spaces and infrastructure, while poorer neighbourhoods are more likely to be affected by polluting activities like waste incineration plants (Dushkova and Haase, 2020; Harvey, 2012; Williams, 2021). Moreover, circular and sustainable initiatives can increase housing prices and lead to gentrification (Kębłowski et al., 2020). It is therefore important that local governments think more clearly about how the CE is governed and who would be advantaged or disadvantaged in the implementation of circular policies or actions. This can be achieved through a myriad of participatory mechanisms that give citizens not only a voice but actual power over policy decisions such as participatory budgeting processes, citizen assemblies and deliberative councils (Bookchin, 1982; Kusumo, 2012; Prendeville et al., 2018; Savini, 2021b; Thomson and Newman, 2020; Voytenko Palgan et al., 2021). Research on deliberative democracy shows that these democratic mechanisms not only improve the engagement and empowerment of citizens in the construction of their city but, also lead to more sustainable and progressive policies than top-down forms of decision-making (Calisto Friant, 2019; Dryzek et al., 2019; Fishkin, 2018; Fung and Wright, 2001).

6.5.5 Sustainable post-growth urban planning

One key insight from this research is the apparent lack of attention, across all our case studies, to interventions and policies in the area of urban form and territorial planning. This is a striking omission since urban planning policies have a huge impact on a city's consumption of material resources by determining the use of land through zoning, and enabling the development of key infrastructure such as roads, highways, train stations, bridges, metro lines, parking spaces, parks, gardens and avenues (Elmqvist et al., 2021; Folke et al., 2021; Ness, 2021; Xue, 2014). As these investments will remain for the very long term, these policies establish important path dependencies and infrastructure lock-ins and will thereby determine the historical shape and morphology of the city and its overall ecological footprint (Du Plessis, 2012; Joensuu et al., 2020; Thomson and Newman, 2020).

Urban planning has historically operated as a major engine of economic growth and development (Ferreira and von Schönfeld, 2020). Within a capitalist context, where cities must compete for resources and investments, zoning laws have been used to attract private capital by maximising the profitability and economic value of land (Savini, 2021b). In this quest for economic growth and competitiveness, cities have commodified and destroyed arable land and biodiverse ecosystems and have dispossessed and displaced poor communities and vulnerable populations to make space for infrastructure that benefits the interests of capital such as upscale real estate, malls, shipping warehouses and airports (Ferreira and von Schönfeld, 2020; Ruiz-Alejos and Prats, 2021; Savini, 2021b; Spanier and Feola, 2022). In the same manner, zoning, and planning have been used to push unwanted developments in poor areas, thereby replicating territorial patterns of environmental injustice (Agyeman and Evans, 2004; Derickson, 2014; Harvey, 2012; Martinez-Alier, 2021a; Shah et al., 2018). National austerity policies and globalized markets have further intensified this trend in planning practices as cities depend on limited tax revenues in order to invest in social and environmental goods and services like parks, public areas, schools and social housing (Ferreira and von Schönfeld, 2020; Savini, 2021b). There is thus currently a dichotomy in planning approaches between, on the one hand, the need to be competitive and open the door for capital to obtain resources necessary for social investments, and, on the other hand, the environmental injustice, ecological destruction, and social segregation and gentrification that this causes. Capitalist, growth-based city planning is thereby a constant process of senseless destruction whereby municipalities compete for resources to create social and environmental projects by undermining the very social and environmental fabric of their cities.

Nevertheless, there are other forms of planning, that subordinate economic growth to social needs and ecological imperatives (Delgado Ramos, 2015; Escobar, 2019; Ferreira and von Schönfeld, 2020; Ruiz-Alejos and Prats, 2021; Savini, 2021b; Spanier and Feola, 2022). Despite some strong social and ecological narratives, no city from our case studies embraced these approaches to break free from the contradictions and injustices brought about by growth-focussed urban planning.

Post-growth and post-capitalist planning policies advocate for the establishment of consumption limits to ensure scarce planetary resources are equally distributed and accessible with a logic of equity and sufficiency, that is, "enough for everyone, for-ever" (Alexander, 2015). This is particularly important in the case of housing, due to its high ecological footprint and unequal distribution (Christis et al., 2019; Joensuu et al., 2020; Lehmann, 2013; Spiegelhalter and Arch, 2010). Degrowth and post-growth policies in the housing sector thereby seek to redistribute unused and under-used buildings to housing cooperatives and prevent the accumulation of building stock through speculation and vacancy taxes, limits to housing ownership per capita, banning new single-family housing, limits to new housing size, rent controls, minimum occupancy rates etc. (Alexander and Gleeson, 2021; Crabtree, 2006; Krähmer, 2022; Lehtinen, 2018; Marín-Beltrán et al., 2022; Savini, 2021b; Xue, 2021; Zárate, 2011). By setting ecologically responsible and fair limits, these policies thereby promote equal access to housing for all within planetary boundaries.

Consumption limits can also be established by protecting and restoring biodiversity through policies like setting limits to land artificialisation, prohibiting the destruction of arable land, establishing strict protection of green corridors and belts, creating conservation areas, banning extractive activities, and replacing grey infrastructure with green infrastructure (by transforming parking lots, roads, and highways into gardens and parks, creating green roofs and walls, greening public areas etc.) (Dushkova and Haase, 2020; Haluza-DeLay and Berezan, 2013; Hong et al., 2014; Ruiz-Alejos and Prats, 2021; Savini, 2021b; Wang et al., 2012). These policies not only improve the health of urban ecosystems but also deliver a plurality of ecosystem services such as flood protection, heat attenuation, air purification, carbon sequestration, food production, improved mental and physical wellbeing and connection with nature etc. (Baffour Awuah and Booth, 2014; Benyus, 2015; Deng et al., 2012; Du Plessis, 2012; Dushkova and Haase, 2020; Schneider et al., 2019; Spiegelhalter and Arch, 2010).

Limits can also be set for transportation and the physical expansion of the city. This can be done by banning, limiting, or restricting private vehicle access while reducing the need for transportation altogether by building compact multi-functional neighbourhoods as well as promoting a variety of alternative green transport options (cycling paths, bike-sharing and parking, quality public transport, attractive footpaths and sidewalks etc.) (Baffour Awuah and Booth, 2014; Delgado Ramos, 2015; Prendeville et al., 2018; Spiegelhalter and Arch, 2010). These multi-functional planning policies not only reduce a city's occupation of land but also create convivial neighbourhoods where offices, housing, parks, markets, education, public transport, healthcare, and other key urban infrastructure and services are easily and quickly accessible for all people (including disabled, elderly, children, women and other vulnerable or marginalized groups) (Baffour Awuah and Booth, 2014; Carrière et al., 2020; Crabtree, 2006; Hirwani and Vaiya, 2020; Hong et al., 2014; Krähmer, 2022; Kusumo, 2012; Spiegelhalter and Arch, 2010; Thomson and Newman, 2016; Xue, 2014).

6.5.6 Policy recommendation

The policy recommendations developed and presented in this chapter are resumed in Table 6.8. These recommendations are based on the most socially and ecologically impactful actions mentioned in the literature we reviewed which, despite their importance for sustainability and circularity, were missing from our selected case studies. These recommendations are therefore developed as complements to the current CE policies and actions at the city level. Moreover, they should not be implemented by themselves, but rather as a set of actions, that must first and foremost, be developed with the direct and active participation of local citizens through democratic and deliberative mechanisms. While these recommendations were built based on our analysis of three European cities, they might be relevant for other cities in the global north and south alike if they are democratically adapted and contextualized.

TABLE 6.8 | Summary of Policy Recommendations.

	Section where it is discussed
Fostering a socio-cultural transformation away from capitalist hyperconsumerism and hypercompetitiveness and towards slower, healthier, and more convivial ways of life through community-owned media sources, restrictions on advertisements, environmental education and promotion of non-materialist values and community ethics.	6.5.2
Circulating money, wealth, knowledge, and power throughout the local economy in democratic and redistributive manners by creating and supporting non-profit cooperative production, banking, and housing systems (of the social and solidarity economy).	6.5.3
Establishing and facilitating participatory mechanisms for the development, governance, and implementation of CE policies (such as participatory budgeting processes, citizen assemblies and deliberative councils).	6.5.4
Implement post-growth urban planning approaches by creating compact multi-functional neighbourhoods (with easy and quick access to urban infrastructure and services), by redistributing and preventing the unfair and unsustainable accumulation of housing stock, and by conserving and restoring biodiversity.	6.5.5

6.6 Conclusions and reflections

In answering the research question posed by this chapter, we first developed a framework to critically analyse the CE policies of different cities. This framework proved to be a useful tool to objectively and systematically analyse each city's CE strategy. Indeed, the framework identified a wide range and variety of circular city policies that are possible, and our case study's commitments to those policies.

When applying this framework, we found that the CE policies of Amsterdam, Glasgow, and Copenhagen, are currently dominated by technological optimist discourses and policies, which seek economic growth through eco-economic decoupling. We have evidenced the key limits of this approach based on academic research on the topic and conclude that it could lead to more social and environmental impacts than benefits. While some social justice discourses are established by Amsterdam and Glasgow, these visions do not lead to sufficiently transformative policies and actions. We propose 4 policy recommendations to overcome the limitations we saw in the CE policies implemented by our case studies and help towards the construction of sustainable circular cities (see Table 6.8).

In the future, the framework we developed in this chapter could be used by practitioners and academics alike seeking to assess their city's CE policies and develop further recommendations in the policy areas where they find CE actions are most lacking and most needed. Indeed, by providing a plural and diverse list of possible circularity policies the framework could be used as a reflection and planning tool for academics and practitioners seeking to understand the broad range of possible CE policies and to choose and adapt those which they find most relevant for their socio-ecological context. It can also be used as an education and facilitation tool for participatory planning and policy development workshops with citizens to help raise awareness and understanding regarding the diversity of CE policies and visions that are possible. Finally, it can be used for transdisciplinary research practices with societal stakeholders involved in urban CE development and planning. In any future use of the framework, we highly encourage its continuous improvement, adaptation, and expansion to reflect local contexts and new policies in the area. The framework is best used and understood as an open contribution to the academic debate and the practice of sustainable and circular urban planning.

It is also worth discussing some of the limitations regarding the research methods and results. First, we only looked at 3 case studies of wealthy cities in Europe. While this choice emanated from our case study selection criteria, this has obvious limitations in terms of the replicability of the framework and the recommendations we have provided. Further research in other cities with different social, economic, and cultural contexts would thus be necessary. It is particularly important for future research to focus on less researched case studies in the Global South. After all, that is where most of the urbanization is going to happen in the future, as it is estimated that urban population growth in the Global South will require the construction of built infrastructure to provide the basic needs of 1 million people every 5 days until 2050 (this is the equivalent of building 10 cities the size of Hong Kong every year) (Thomson and Newman, 2020). While the academic literature reviewed to develop the framework included publications and case studies from the Global South, the framework itself was not tested for validity in cities in that context. This is a promising avenue for future research not only to better understand urban CE policy implementation in the Global South but also to adapt and improve the framework for those cities and regions.

Second, it is worth mentioning that some social justice, energy, transport or planning policies of the analysed cities might be established in other non-CE-related policies or plans which we did not assess here. Our focus was to analyse how our case studies understood and led the transition to a CE through their policies and their discourse. It is therefore important to look only at documents relating specifically to their CE policies to evidence what they found important for this transition rather than in other policy documents aimed at other social or ecological goals. In future research, other policy plans and strategies, that are not explicitly on CE could also be included in the analysis, but it should be kept in mind that this analysis will not be capable of reflecting a city's discourse and vision of CE.

Third, one might question the feasibility of our recommendations as they might need a transformation of an entire national economy beyond the city scale. Indeed, while cities offer unique opportunities for social innovation and transformation, they are also limited by the structural conditions of the capitalist system in which they are embedded. Post-growth and post-capitalist planning approaches might try to promote socio-cultural change, yet if systemic conditions push for increased consumption and production and unsustainable materialist lifestyles, then cities might have a limited scope of impact. Nonetheless, the fact that alternative policies might be hard to implement is only secondary to the fact that, considering the current socio-ecological impacts of growth-based capitalist planning, an alternative is urgently needed, and it must be implemented as quickly as possible (IPCC, 2022). Moreover, research shows that such approaches have had positive impacts in some cities such as Preston and Cleveland (Manley and Aiken, 2020; McInroy, 2018; Roberts, 2017; Song, 2016; Sutton, 2019). Finally, the democratic development of these policies is what matters most. When brought to deliberate and decide on sustainability policies in a fair, informed and democratic manner, citizens tend to choose much more radical approaches than politicians and government officials (Fishkin, 2018; Fung and Wright, 2001). There is therefore a realistic possibility that post-growth city planning policies could be brought about through democratic innovations like participatory budgeting and deliberative assemblies.

All in all, it is quite positive to find that some cities like Amsterdam and Glasgow are embracing more holistic versions of circularity and are starting to question the impact of their economic models beyond their borders. On the other hand, it is rather disappointing to find that their implementation remains limited and leaves much to be desired. This dichotomy between discourses and policy actions could be explained by the complexities of creating political support for more transformative policies. Decision-makers might be forced to make political compromises that dilute radical and transformative policies to secure their political acceptance and prevent outright opposition by more conservative municipal stakeholders. As academics, we must point out these inconsistencies and propose alternative policies that address the limitations of current policy approaches. This is precisely what we have sought to do with the policy recommendations we have developed in the discussion section. However, more research is still needed on the topic to help cities transition to fair and sustainable circular societies. Future research should examine the CE policies of other cities, especially in less researched case studies, and in the Global South. Future research should also further develop policy actions and recommendations to help city planners and practitioners create convivial post-growth cities that place social needs and ecological imperatives above economic growth and capital accumulation. We hope the policy framework suggested in this chapter could help academics seeking to analyse city-level CE policies, and practitioners seeking to develop their CE policies and needing a diverse list of possible actions.

Chapter 7

Conclusions

"The means for tearing down the old are available, both as hope and as peril. So, too, are the means for rebuilding. The ruins themselves are mines for recycling the wastes of an immensely perishable world into the structural materials of one that is free as well as new." (Bookchin, 1982, p.347)

7.1 Summary of key results and insights

This thesis started by posing the following question: What are the main societal discourses and policies on the CE, how can they be critically analysed, compared, and understood, and what are their sustainability implications? To answer it, this thesis developed a typology of circularity discourses that served as a conceptual framework to critically analyse, compare, and understand different circular discourses and policies (chapter 2). It then analysed circularity policies and discourses at the international level (chapter 4 on the EU), at the national level (chapter 3 and 5 respectively on tyres and plastic packaging in the Netherlands) and at the city level (chapter 6 on Amsterdam, Glasgow, Copenhagen).

The typology developed in chapter 2, contributes to a better understanding of the large diversity of academic and conceptual approaches to circularity. It divides circularity discourses based on two broad criteria. First, whether they are *optimist* or *sceptical* regarding the possibility that economic growth can be decoupled from environmental degradation fast enough to prevent a socio-ecological collapse. Second, whether they are *holistic* by including social justice and political empowerment considerations or whether they are *segmented* by focusing on material efficiency alone. This differentiation leads to 4 broad circular discourse types: *Technocentric Circular Economy* (*optimist* and *segmented*), *Reformist Circular Society* (*optimist* and *holistic*), *Transformational Circular Society* (*sceptical* and *holistic*), and *Fortress Circular Economy* (*sceptical* and *segmented*) (see Figure 7.1). Chapter 2 found that 84% of 120 definitions of CE it reviewed fall in the *Technocentric Circular Economy* discourse type, while most of the 72 CE-related concepts it reviewed from the historical academic literature fall either into *Transformational Circular Society* (42% of reviewed concepts) or in *Reformist Circular Society* (28% of reviewed concepts, see chapter 2 for details). The analysis hence highlights a divergence between the large diversity of *holistic* and *sceptical* approaches to circularity in the academic literature and the narrow focus on *Technocentric Circular Economy* discourses in the current discussions and definitions of the topic. A more inclusive, democratic, and diverse debate on CE is hence lacking and this lack of pluralism leads to a dominance of circularity discourses and practices that fail to address the seven key cycles presented in the introduction. Indeed, this thesis finds that only resource cycles - and to some extent biogeochemical and ecosystem cycles - are included in the mainstream CE debate, while cycles of power, wealth, care and knowledge are largely absent. All in all, chapter 2, seeks to help societal actors see the CE beyond the singular techno-optimist discourse on the concept. It thereby hopes to foster a cross-pollination of ideas, policy options, strategies, practices, and solutions from a plurality of different circularity visions and perspectives. Figure 7.1 below presents an artistic representation of each of the 4 discourse types developed in chapter 2. The image details the type of future and socio-economic system that each circularity discourse represents, with the mix of agricultural, industrial, housing, energy, consumption, and transport systems they would engender. It can help visualise the full picture and diversity of circularity discourses that exist, with their key differences and commonalities. It can also help imagine a plurality of solutions, practices and policies that can be developed within different circularity approaches. Finally, it can help define democratic agreements and common visions regarding the shape and type of circularity transition that people can aspire to co-design and co-create.

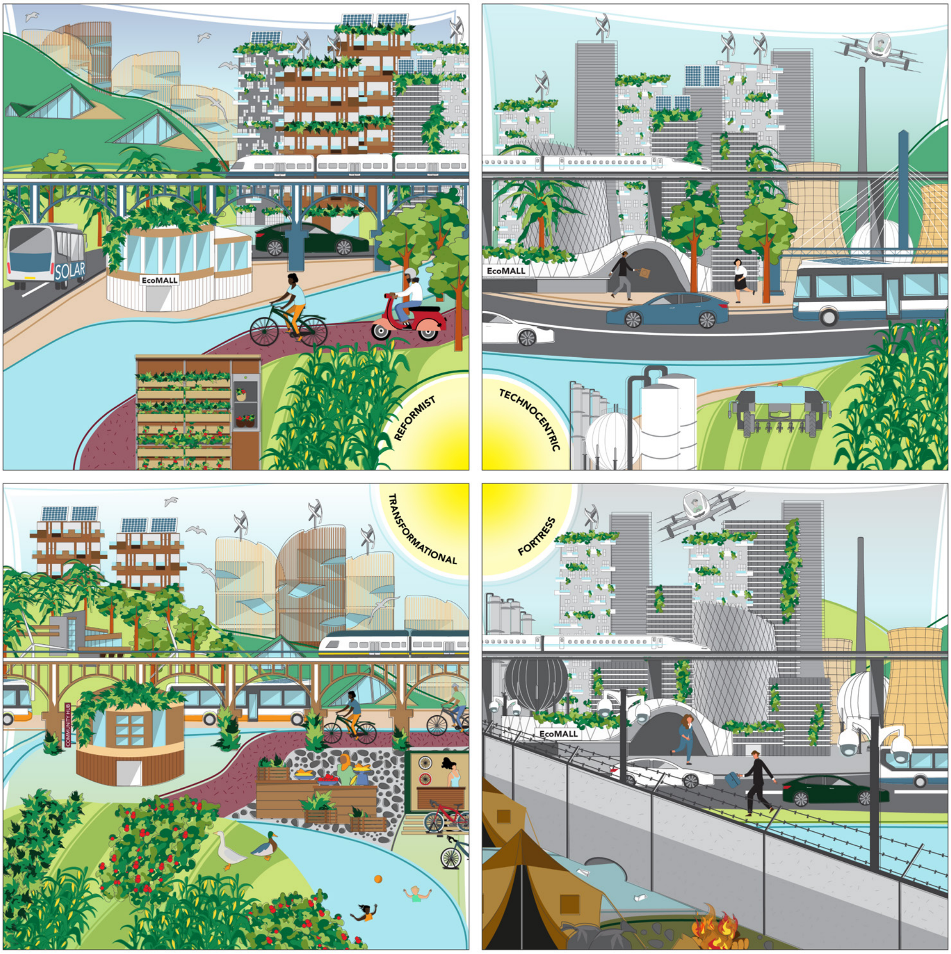


FIGURE 7.1 | Visual representation of the circularity discourse typology.

Findings from the analysis of CE policies and practices in the Dutch end-of-life passenger car tyre management system demonstrate that it relies heavily on an EPR system that gives a lot of leeway to the private sector regarding how tyres are recovered and processed (chapter 3). Despite achieving world-leading collection and recovery rates and zero-landfilling, the EPR system focuses mostly on end-of-pipe solutions, especially recycling (R7), rather than refusing (R0), and reducing (R1) tyre usage or increasing their lifespan. Tyre consumption has hence increased by about 20% from 2004 to 2017. Moreover, there is a lot of uncertainty regarding the final whereabouts of a large proportion of end-of-life tyres, as about 33% of them are exported for re-treading or reuse. Yet there is little information on where exactly they are sent or whether they will be processed in a sustainable manner once they reach their end-of-life in those countries. Research has shown that these wastes can end up in the Global South in countries that often have limited technical and/or administrative capacities to ensure high social and environmental standards in the collection and recovery of waste (Bishop et al., 2020; Thapa et al., 2022a). Results from chapter 3 thus reveal that the underlying discourse and policy approach for end-of-life passenger car tyres is based on a *Technocentric Circular Economy* vision, which does not address key social cycles, and focuses on technological solutions (especially R7) rather than reducing the consumption of tyres (R0). To address these issues, chapter 3 suggests several alternative policies such as working with producers to improve the durability and lifespan of tyres (R1) and reducing the need for car tyres by improving public transport, cycling and pedestrian infrastructure and discouraging private vehicle use (R0). Including civil society organizations in the governance of the EPR system in a democratic manner could also improve the attention to social and ecological considerations in its decisions and actions.

Chapter 4 zooms out to the European scale by analysing the CE policies of the Junker Commission (2014-2019). Results show that the discourse of the EU is rather *holistic* and includes various social justice and public participation considerations. However, the policies the EU enacted are focused on technocentric solutions such as recycling and eco-design. The EU's discourse thereby fell in the *Reformist Circular Society* discourse type as it addresses some of the key cycles of power, knowledge, wealth, and ecosystems discussed in chapter 1. Yet, its policies focused on resource efficiency from a technocentric perspective, as they did not include actions on social justice, climate change or biodiversity and they did not seek to reduce the EU's overall resource use or ecological footprint. The EU policies of the Junker Commission are hence in the *Technocentric Circular Economy* discourse type. Chapter 4 concludes that a more democratic and plural debate on the CE at the EU level, which includes a diverse set of circularity discourses and stakeholders, could strengthen EU policies on circularity. Chapter 4 thus suggests improving the participatory nature of decision-making at the EU level. It also suggests 32 alternative policy options from a plurality of different circularity discourses, that could reinforce the weaknesses of the EU's current CE strategy. These policies include actions such as reducing working hours; promoting open-source innovations; increasing product guarantee periods; promoting healthy plant-based diets; and increasing financing and technology transfer to the Global South for climate change, biodiversity, and circularity projects.

The findings of chapter 5, which analysed the discourse and policies for the transition to a circular plastics economy in the Netherlands, are very much aligned with the findings of chapter 3 on tyres. Results show that the Netherlands' end-of-life plastic management is also based on an EPR system, which focuses on technological solutions and innovations such as recycling (R7) rather than reducing the consumption of plastics in the first place (R0-2). Moreover, chapter 5 also found, that despite having world-leading plastic recycling rates (57% in 2019), the Netherlands relies on the export of plastic waste to the Global South to achieve its recovery targets. There is thus a *Technocentric Circular Economy* approach to plastic in Dutch policies and practices that does not address key social cycles of care, wealth, power, and knowledge. To address these issues, chapter 5 suggests a broad range of policy recommendations such as a) reducing plastic consumption by encouraging reusable packaging, b) taxing raw materials and reducing taxes on recycled or reused materials, c) providing financial and technical assistance to improve the recovery infrastructure in the Global South and fund clean-up activities, and d) establishing eco-modulated EPR fees calculated based on the socio-ecological impact of products and their packaging. Chapter 5 also encourages more systemic solutions to reduce the demand for unnecessary consumption and support local value chains and food networks.

Finally, chapter 6 zooms into the local scale by analysing the circularity policies of three European cities at the forefront of the CE transition: Amsterdam, Glasgow, and Copenhagen. Results show that all three cities have a growth *optimist* approach to circularity, which focuses primarily on technological innovation and resource efficiency to improve economic competitiveness and develop local recovery industries. Results also demonstrate that Amsterdam and Glasgow have a *holistic* discourse regarding social justice and even acknowledge the significant social and environmental impacts of their high consumption levels on the Global South. However, the policies taken to address social issues leave much to be desired as they remain at an explorative stage and mainly consist of small pilot programs or research projects to support sharing economy initiatives, community repair networks and urban agriculture projects. The discourse and policies of Amsterdam and Glasgow can hence be placed in the *Reformist Circular Society* type, as they include some social considerations, while the policies and discourses of Copenhagen are clearly within the *Technocentric Circular Economy* discourse type as they focus exclusively on economic competitiveness and resource efficiency. To address the limitations of these policies and build more inclusive, diverse, and democratic circular cities, chapter 6 suggests various policy actions. To better redistribute power, wealth, care, and knowledge cycles the chapter proposes encouraging the redistribution of unused building stock (e.g. through speculation and vacancy taxes) and promoting non-profit cooperatives (e.g. through public procurement practices). To overcome the growth paradigm in planning, the chapter suggests policies that create compact multi-functional neighbourhoods and reduce the need for motorised transport, as well as policies that conserve and restore biodiversity. Finally, the chapter encourages democratizing decision-making processes through various mechanisms such as participatory budgeting processes and deliberative assemblies that can determine the course of the circularity transition in an inclusive manner.

The results from all chapters of this thesis demonstrate that growth *optimist* discourses currently dominate the policy debate on circularity despite the plurality of alternatives that exist. These results are very much in line with the research of other academics analysing dominant CE discourses, perspectives and approaches in governments and businesses

(Diaz et al., 2021; Klein et al., 2021; Newsholme et al., 2022; Pollex and Lenschow, 2018; Roos Lindgreen et al., 2020; Santa-Maria et al., 2021b; Simoens and Leipold, 2021; Stumpf et al., 2021; Völker et al., 2020; Walker et al., 2021, 2022). Further research could examine local perceptions and citizen opinions on CE to contrast the dominance of *Technocentric Circular Economy* discourses in the public and private sector with the kind of circular discourse most citizens would actually prefer[55].

Two recent surveys in France suggest that most citizens would seem to prefer a *Transformational Circular Society* discourse type. The first survey by Odoxa found that, to address current socio-ecological challenges, over 54% of respondents think it is more important to fundamentally transform our ways of life and reduce consumption levels than to invest massively in green technologies and innovations (Odoxa, 2019). The second survey by the Observatory of Utopic Perspectives found that 54.6 % of respondents prefer a sufficiency-oriented and inclusive ecological utopia rather than a growth and technology-oriented neoliberal utopia (15.9%) or a conservative traditionalist utopia (29.5%) (Observatory of Utopic Perspectives, 2019).

These results suggest that the *Technocentric Circular Economy* discourse, which dominates the current debate on circularity, does not necessarily align with what citizens would prefer when they are asked to think of a circular future. While these surveys only cover a specific country, many other studies find that, when citizens openly and freely deliberate in a well-informed, inclusive, and democratic environment, they tend to make significantly more sustainable decisions than politicians (Cabannes, 2018; Calisto Friant, 2019; Dryzek et al., 2019; Fishkin, 2018). Research even finds that, in a democratic context, citizens choose to forgo personal gains for the benefit of future generations (Hauser et al., 2014). More research is needed to gain a better picture of what CE discourses people find most appealing and what CE policies they would choose in a democratic context. Indeed, a more diverse, democratic, and inclusive construction of a circular future is needed to better include the plurality of citizens' discourses and perspectives on CE. A deliberative governance process that hands decision-making power to citizens could better address the key social cycles of care, knowledge, wealth, and power and help towards the construction of CE policies that subordinate economic growth to real resource limits and planetary boundaries.

7.2 Strengths and limitations of results and methods

A wide variety of research methods were used throughout this thesis. All chapters took an interdisciplinary approach with a mix of qualitative and quantitative methodologies.

55 in April 2021 we launched a global survey on circular perceptions. The survey was developed in collaboration with Revolve Circular and was answered by 1150 people from 77 different countries. The analysis of results was published in the following report: Calisto Friant, M., W.J.V. Vermeulen, L. Campos Bernal, S. Bauer (2022) H*ow do you imagine a Circular Economy? Survey Report*, Utrecht University & Revolve Circular, https://doi.org/10.5281/zenodo.7308056

Chapter 2 used a critical literature review and participant workshops; chapter 3 is based on data and policy analysis, as well as stakeholder interviews; chapter 4 is based on quantitative corpus-based word mining and qualitative policy and discourse analysis; chapter 5 is based on a mix of media analysis, policy analysis, semi-structured interviews, and surveys using Q-methodology; and chapter 6 is based on a critical literature review leading to the development of a circular city policy-discourse framework used to conduct a policy and discourse analysis. This diversity of methods enabled the thesis to test the typology of circularity discourses developed in chapter 2 and confirm its relevance with various case studies and methodological approaches. The consistent results obtained throughout the chapters reinforce the scientific validity and usefulness of the typology as a conceptual tool to analyse circular discourses and policies.

The typology has also obtained a good reception by academics and practitioners alike. The typology article has 210 citations on Google Scholar and 104 citations on Scopus so far (updated on October 4th 2022) and it has been used in other research such as the analysis of CE discourses in Norway (Hermann and Pansera, 2020; Ortega Alvarado et al., 2021), CE discourses in Australia (Melles, 2021), urban living labs in the City of Tampere, Finland (Särkilahti et al., 2021), and the EU plastics strategy (Palm et al., 2021). In line with the findings of this thesis, all the above-mentioned papers also found that *Technocentric Circular Economy* discourses were dominant in their respective case studies.

Moreover, it is worth mentioning some international organizations, NPOs, and government institutions that have cited the papers developed in this thesis such as UNEP (United Nations Environment Programme and United Nations Human Settlements Programme (UN-Habitat), 2021), the Netherlands Environmental Assessment Agency and the Netherlands Bureau for Economic Policy Analysis (Dimitropoulos et al., 2021), the Council of Canadian Academies (Council of Canadian Academies, 2021), the Purpose Capital Impact Fund (Wilkins and Murphy, 2021), the German Environmental Agency (Wagner et al., 2022), The European Commission (European Commission, 2022), and Circle Economy (Circle Economy, 2022). The uptake of this thesis's findings by these organisations, operating within and outside Europe, evidences the societal relevance of this research.

Despite the strength and diversity of the methodological and conceptual approach taken by this thesis, it also has some limitations. First, policy and discourse analysis have a strong unavoidable subjective component as they involve qualitative assessment and judgment by the researchers. To limit this bias, results were always cross-checked with the various researchers involved in each chapter. Moreover, all chapters combined quantitative and qualitative tools to strengthen the validity and objectivity of their respective methods. On the other hand, this mixed-use of qualitative and quantitative methods is rather complex and time-consuming, which means they could be hard to replicate. Further research on policy and discourse analysis on sustainability and circularity would be highly beneficial to cross-check these results with different methods.

Much of this thesis is based on the circularity discourse typology developed in chapter 2, yet as with any other conceptual framework, it provides a simplified view of a complex and nuanced reality. A continuous improvement of this typology to refine it and expand it with new concepts and ideas is thus welcome for future research on the topic[56]. The use and improvement of the circular city policy-discourse framework developed in chapter 6 is also highly encouraged for future research. The typology and the framework can best be seen as an open dialogue on the diversity of circularity thinking and practice to be continuously updated and improved by scientists and practitioners alike.

Transdisciplinary research methods could be particularly valuable for future research on circularity discourses and policies. The findings of this thesis have demonstrated the need for greater inclusivity and pluralism in the development of CE visions, policies, and practices. Participatory and transdisciplinary methods can address this key challenge especially by working with societal actors in the co-creation of innovative CE policies, solutions and approaches (Delgadillo et al., 2021; Santa-Maria et al., 2021a; Thapa et al., 2022b; Vermeulen and Witjes, 2020). A plurality of views can thus be bridged, and a more democratic and inclusive circularity transition can be created. Participatory action research approaches, which empower and give a voice to disenfranchised and vulnerable people[57] could be especially useful in future research projects to better understand the complex socio-ecological implication of circular policies and projects (Eelderink et al., 2020; Fals-Borda, 1987). These methods could also contribute to a better understanding of what kind of circular discourse people might prefer and how they would like to get there. In conducting transdisciplinary research on CE, the circularity discourse typology and the circular city policy-discourse framework could serve as valuable tools to guide the debate and help expand the discussions regarding the plurality of circular discourses and policies that exist (see Figure 7.1 in particular).

7.3 Reflections on the sustainability implications of results

Several valuable insights and sustainability implications can be drawn from research results. This section focuses on two main implications: first, in relation to the dominance of *growth-optimist* discourses, and second, regarding the dominance of *segmented* discourses, which don't address social cycles (see Figures 2.5 and 7.1).

7.3.1 On the dominance of growth *optimist* discourses

Results demonstrate that powerful public institutions like the EU and the Municipality of

56 A few additional concepts and ideas were added tot the typology and the respective timeline, which can be found in the online and interactive version of the timeline: https://cresting.hull.ac.uk/impact/circularity-timeline/

57 PAR and other action research approaches are sometimes called "fairness-driven transdisciplinarity" (see Figure 2.5 in Vermeulen and Witjes, 2020).

Copenhagen as well as powerful private institutions like the packaging and tyre industries in the Netherlands have chosen a technocentric path to circularity. These powerful states and businesses have led the overall discourse and practice of CE towards policies and actions, which do not address the social cycles of care, power, knowledge and wealth. Moreover, when some powerful actors take a more *holistic* approach to circularity, like the cities of Amsterdam and Glasgow, they do so in growth-optimist manner, which could lead to environmental rebound effects. *Sceptical* CE approaches like *Transformational Circular Society* and *Fortress Circular Economy*, are hence notably absent from policy debates and practices. The work of Naomi Klein (2014), Georgios Kallis (2019), David Harvey (2012), and Tim Jackson (2021) has demonstrated that mainstream growth-optimist sustainability discourses were manufactured and promoted by powerful economic and political elites to reinforce their interests and safeguard their positions of power. Indeed, the *Reformist Circular Society* and *Technocentric Circular Economy* discourses that dominate the current debates do not fundamentally challenge present societal structures and systems of power. Instead of "shrinking and sharing" global resources and wealth to meet global societal needs within planetary boundaries, these discourses opt for technological solutions that allow the maintenance of current property relations and divisions of wealth and labour. However, this ecomodernist path to circularity is problematic from a scientific standpoint, because the core assumption of this discourse regarding the possibility of decoupling economic growth from environmental degradation has been clearly rebutted by academic research on the topic (Haberl et al., 2020; Hickel and Kallis, 2019; Jackson, 2016; Parrique et al., 2019; Wiedenhofer et al., 2020). Growth o*ptimist* circularity discourses and futures could thus quickly run into fundamental resource constraints as the thermodynamic limitations of recycling and renewable energy technologies make the actual implementation of these visions impossible. These discourses might thus be selling a form of "fairy tale" that replicates an illusion that we could grow the economy forever on a finite planet thanks to perfectly circular loops of resource recovery and recycling. This is what Giampietro and Funtowicz (2020) call a "folk tale" that denies the uncomfortable truth regarding the impossibility of decoupling and the need to move to a post-growth, and therefore, post-capitalist society to ensure human and planetary wellbeing.

Growth *optimist* imaginaries of the future might be appealing at first because they do not require fundamental changes to our ways of life, but they are also scientifically unrealizable and unjust. Policies that aim for a *Reformist* or a *Technocentric* future can thus end up creating a reality closer to *Fortress Circular Economy*, as real resource shortages and ecological boundaries will constrain the realm of possibilities. There is a danger that, as current socio-ecological problems intensify and climate change impacts worsen, people could entrench in ethnocentric and xenophobic discourses and policies to protect their wealth and their access to key resources. Droughts, floods, wildfires, heatwaves, crop failures, energy restrictions and resource constraints could cause human conflicts, resource scarcities, economic hardships, and forced migrations that could increase the appeal of

Fortress Circular Economy discourses. While this discourse type did not appear in any case study analysed by this thesis, other researchers have found a rise in eco-fascist and far-right ecological discourses in Europe and beyond (Campion, 2021; Hughes et al., 2022; Reid Ross and Bevensee, 2020; Thomas and Gosink, 2021). Further research of these discourses and their potential impacts and consequences is necessary. Further research on growth *optimist* CE discourses is also needed to draw attention to their biophysical limitations and socio-ecological implications. Moreover, as Christian Felber (2015) puts it, "there are plenty of alternatives" to capitalist growth-based imaginaries thanks to a rich history of social movements and ideas from the Global North and South alike that propose radically different ways of living and flourishing (e.g. degrowth, buen vivir, ecological swaraj, steady-state economics etc.). Further research, understanding and practice of these alternatives can help us face the manyfold socio-ecological challenges of the 21st century in a democratic and inclusive manner.

7.3.2 On the dominance of *segmented* discourses

The findings of this thesis demonstrate that most CE discourses and policies are *segmented*, as they don't address key social cycles. Dominant CE visions thus understand resource flows and cycles as purely physical processes, which are disembodied and alienated from their social contexts. Yet resources come from specific places, through particular market structures and value chains, which are owned by certain institutions and lead to specific conflicts in the distribution of costs and benefits. Moreover, resources are extracted, transformed, transported and disposed by people, working under specific circumstances in distinct countries with key differences in wages, labour rights, occupational health, democratic structures, cultures, and overall living conditions. Resource cycles are thus inexorably rooted in social practices and structures, with key geopolitical, social, and economic dimensions. Within the current global capitalist system, these relations often replicate structures of injustice and exploitation of humans and nature (Harvey, 2012; Hickel, 2021; Jackson, 2021). Those on the periphery of the global economy extract natural resources to supply an endless stream of goods and services (Marín-Beltrán et al., 2022; Martinez-Alier, 2021b). This often leads to the destruction of livelihoods, and ecosystems throughout the globe, for the benefit of a minority of people in the large powerful centres of global capital accumulation of the Global North[58] (Martinez-Alier, 2021b). If the complex social and biophysical implications of these wealth, power, and resource cycles, are not carefully examined and understood, then we are bound to replicate relationships of social and environmental injustice, marginalization, and exploration. Addressing all the seven flows and cycles mentioned in the introduction can therefore be helpful in comprehensively dealing with the multiple interrelated socio-ecological crises that our world currently faces. Further research on these entangled socio-ecological cycles and the manyfold social implications

58 By Global North, we not only mean a geographical representation of the countries of the OECD, but also the wealthiest economic and political actors in so called "low- and middle-income countries".

of resource and material flows is needed in the future. In that regard, research on the public policies to transition towards a fair and sustainable circular society that considers all the seven socio-ecological cycles is particularly important.

Findings, from chapters 3 and 5 evidenced that at least 30% of end-of-life plastics and tyres from the Netherlands are exported to what Martinez-Alier calls "waste disposal frontiers" in the Global South (Martinez-Alier, 2021a). Those waste materials are thus "out of sight and out of mind" for the powerful centres of capital expansion, consumption and accumulation in Europe (Barnes, 2019). Yet these materials do not cease to exist, they take a new life, serving a multitude of formal and informal economic actors in the Global South. Unfortunately, research also suggests that these materials are often recovered, reused, cannibalised, and repurposed in socially and environmentally harmful ways (Thapa et al., 2022a). While the export of hazardous waste is highly regulated by international agreements, there is a consistent lack of enforcement across the world. Wastes from the North thus often become socio-ecological hazards in the Global South and often end up in places where the recovery infrastructure is not able to process national waste, let alone foreign waste (Bishop et al., 2020). Yet waste from the Global North is also a key economic resource for people in the Global South, which makes it a complex challenge. Global inequality and poverty create conditions whereby waste is an unwanted discard of consumption for some, all while becoming a valuable economic resource and a health hazard for others. Further research on the transboundary movement of waste is necessary to better understand the socio-ecological implications of unequal resource consumption and waste disposal across the globe.

7.4 Final thoughts: towards a circular society

To conclude, this research demonstrates that CE is neither a novel concept nor a particularly socially or environmentally relevant one in its current dominant interpretation as it often fails to address the entangled nature of the seven flows and cycles presented in the introduction. Most contemporary CE discourses overwhelmingly focus on material and energy flows, but this is not new as previous ideas, which focus on those flows, have already been extensively researched and developed, such as industrial ecology, cleaner production, industrial metabolism, material efficiency etc. (ideas within CE1.0 and 2.0) (Reike et al., 2018a). The key value and importance of shrinking, slowing, and closing resource loops was indeed already stressed by academics as far back as the 1970s (Boulding, 1966; Commoner, 1971; D. Meadows et al., 1972) and it is a key element of the 1992 Rio Declaration on Environment and Development (UN, 1992). The social implications of circularity and the importance of social flows and cycles have also been extensively addressed by academics in the field, which often remind us that circularity must first and foremost contribute to a fairer, healthier and more convivial society (Arnsperger and Bourg, 2017; Jaeger-Erben et al., 2021; Leipold et al., 2021; Moreau et al., 2017). Scholars have also argued the need for circularity to take a systemic perspective that takes biogeochemical cycles, ecosystems, and global resource limits into account, and therefore, goes beyond economic growth and focuses on reducing the economy's overall environmental footprint (Bauwens, 2021; Genovese and Pansera, 2020; Schröder et al., 2019b; Suárez-Eiroa et al., 2019).

If the CE is to bring any substantial innovation and contribution to the sustainability debate, it should take the above points into account. The CE concept could thereby help broaden our understanding of the various systemic social, material, energy, and biological cycles that shape human and planetary wellbeing. By highlighting the seven cycles presented in the introduction this thesis hopes to contribute to this conceptual development of the CE and improve its social relevance and usefulness for sustainability debates. This thesis particularly calls attention to the need for a circular economy and society that places planetary limits and natural cycles above economic growth, that balances cycles of political power in democratic manners, that redistributes flows of money and wealth in fair and equitable manners, that maintains the free and open circulation of knowledge and ideas, and that ensures that care is cycled throughout society in a reciprocal and convivial manner.

To expand our understanding of the topic and improve the current debate this thesis proposes and develops the idea of a *circular society* as opposed to a *circular economy*. As shown in chapter 2, there is no single concept or vision of a circular society, rather it is an umbrella concept that includes a wide range of different discourses from the Global North and South alike (such as buen vivir, degrowth, voluntary simplicity, ecological swaraj and the like). Moreover, other scholars have proposed the idea of a circular society in their context and fields, all of which closely align with the idea proposed by this thesis (Jaeger-Erben et al., 2021; Jaeger-Erben and Hofmann, 2020; Leipold et al., 2021). All in all, circular society discourses are united in their objective to create a democratic, fair and sustainable socio-ecological system, which works in harmony with the natural cycles of the biosphere to improve human and planetary wellbeing for current and future generations. A circular society can operate through various interrelated strategies including, but not limited to, the following:

- **Shrinking socio-ecological cycles:** reducing the absolute size of flows, through socio-cultural changes for simpler and more convivial lifestyles as well as design and technical changes that reduce or substitute materials (often with a "low-tech" perspective), and thereby shrink the overall societal resource/economic throughput (Alexander, 2015; Arnsperger and Bourg, 2017; Ashby et al., 2019; Bauwens, 2021; Bihouix, 2014; Genovese and Pansera, 2020; Kothari et al., 2019; Latouche, 2018; Ness, 2022; Schröder et al., 2019a).
- **Slowing socio-ecological cycles:** maintaining products as long as possible through product life extension, reusing, leasing, servicing and a focus on functionality, access and stewardship instead of ownership (Antikainen et al., 2018; Blomsma and Brennan, 2017; Bocken et al., 2016; Delannoy, 2017; Goedkoop et al., 1999; Hobson and Lynch, 2016; Merli et al., 2018; Stahel, 2010).

- **Shortening (narrowing) socio-ecological cycles:** repairing, refurbishing, remanufacturing and repurposing goods following a cascading value retention hierarchy to prevent resources from becoming wastes (Allwood et al., 2011; Aurez et al., 2016; Campbell-Johnston et al., 2020b; Delannoy, 2017; Geissdoerfer et al., 2018; Ghisellini et al., 2016; Milios, 2018; Moreau et al., 2017; Reike et al., 2018a).
- **Closing socio-ecological cycles:** recovering components, materials and embodied energy through recycling, bio-digestion, composting, urban-mining and, as last resort options, incineration with energy recovery (Batista et al., 2018; Geisendorf and Pietrulla, 2018; Geissdoerfer et al., 2017; Lorenz et al., 2018; McDonough and Braungart, 2002; Merli et al., 2018; Prieto-Sandoval et al., 2018; Winans et al., 2017).
- **Smartening socio-ecological cycles:** using eco-innovations for optimum resource efficiency and the provision of renewable energy such as eco-design for electrification, durability, multifunctionality, upgradeability, modularity, reusability, repairability, and recyclability as well as ICT innovations such as P2P platforms, blockchain, smart grids, and industry 4.0 (de Jesus et al., 2019; den Hollander et al., 2017; Frenken, 2017; Garcia-Muiña et al., 2019; Kalmykova et al., 2018; Lüdeke-Freund et al., 2019; Stahel, 2010; Tate et al., 2019; Zink and Geyer, 2017).
- **Greening socio-ecological cycles:** using safe, organic, and renewable natural resources and nature-based solutions, while protecting, conserving, regenerating and restoring ecosystems and biodiversity, through agroecology, permaculture, and effective environmental protection (D'Amato et al., 2017; Delannoy, 2017; Geisendorf and Pietrulla, 2018; Geiser, 2001; Korhonen et al., 2018a; Murray et al., 2017; Tate et al., 2019).
- **Democratizing socio-ecological cycles:** democratic governance processes to ensure the equal and meaningful participation of all people in the management of resources both in the public sector (local, national and international governments) and in the private sector (enterprises and NGOs) through direct and deliberative democracy methods such as citizen councils, participatory budgeting, participatory design, worker syndicates, cooperative ownership etc. (Bookchin, 1971; Ede, 2016; Felber, 2015; Jackson, 2021; Kerschner et al., 2018; Latouche, 2009; Moreau et al., 2017; Pansera et al., 2021; Schröder et al., 2020; Velenturf and Purnell, 2021)
- **Redistributing socio-ecological cycles:** ensuring a fair, equal and just distribution of resources, wealth and power, especially considering the unmet needs of the most vulnerable citizens of the earth, through progressive taxation, comprehensive welfare, communal ownership, and open-source knowledge and technologies etc. (Arnsperger and Bourg, 2017; Ashby et al., 2019; Caillé, 2019; Hobson, 2019; Jackson, 2016; Latouche, 2009; Morrow and Davies, 2021; Piketty, 2019; Schröder et al., 2019a).
- **Re-localizing socio-ecological cycles:** ensuring local autonomy, and sovereignty in the provision of basic goods and services, promoting local employment and reducing unnecessary transport costs and industrial delocalization (and thus preventing competition for low labour and environmental standards) by producing at the closest

possible level (Bihouix, 2014; Ede, 2016; Genovese and Pansera, 2020; Hopkins, 2008; Latouche, 2009; Suárez-Eiroa et al., 2019; Tate et al., 2019; Trainer and Alexander, 2019).

The above description of a *circular society* and its core components and operating strategies are best understood as the beginning of an open academic debate on the topic. A debate that could help scholars and practitioners expand their understanding of circularity and embrace a plurality of different discourses and ways of implementing the concept. Although their conceptual underpinnings stretch far back in history, the circular economy and society concepts are still relatively young and remain to be further developed within and beyond academia. Therefore, further research and practice of these concepts is highly encouraged, especially through inter and transdisciplinary approaches that include a wide range of perspectives and societal actors.

Additional materials

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Publications & other materials related to this thesis

Academic publications in this thesis

The following articles were published in academic journals and constitute the content for chapters 2 to 5 of this thesis.

- Calisto Friant, M., Vermeulen, W. J., & Salomone, R. (2020). A typology of circular economy discourses: Navigating the diverse visions of a contested paradigm. *Resources, Conservation and Recycling*, *161*. https://doi.org/10.1016/j.resconrec.2020.104917
- Campbell-Johnston, K., Calisto Friant, M., Thapa, K., Lakerveld, D., & Vermeulen, W. J. (2020). How circular is your tyre: Experiences with extended producer responsibility from a circular economy perspective. *Journal of Cleaner Production*, *270*. https://doi.org/10.1016/j.jclepro.2020.122042
- Calisto Friant, M., Vermeulen, W. J., & Salomone, R. (2021). Analysing European Union circular economy policies: words versus actions. *Sustainable Production and Consumption*, *27*. https://doi.org/10.1016/j.spc.2020.11.001
- Calisto Friant, M., Lakerveld, D., Vermeulen, W. J., & Salomone, R. (2022). Transition to a Sustainable Circular Plastics Economy in The Netherlands: Discourse and Policy Analysis. *Sustainability*, *14*(1), 190. https://doi.org/10.3390/su14010190

Chapter 6 is based on a manuscript under review in the journal *Local Environment*. It is openly available online in the Social Science Research Network (SSRN) repository for preprints as:

- Calisto Friant, M., Reid, K., Boesler, P., Vermeulen, W.J, & Salomone, R., Sustainable Circular Cities: Analysing Urban Circular Economy Policies in Three European Cities. Available at SSRN: https://ssrn.com/abstract=4133478 or http://dx.doi.org/10.2139/ssrn.4133478

Additional publications connected to this thesis

The following academic and popular science publications were developed in connection to this thesis and focused either on better-communicating research results or on developing parallel research activities, in closely related fields and topics.

- Chakori, Sabrina; Ammar Abdul Aziz, Martin Calisto Friant, and Russell Richards (2022) If the UN wants to slash plastic waste, it must tackle soaring plastic production - and why we use so much of it. *The Conversation*, March 2022. https://theconversation.com/if-the-un-wants-to-slash-plastic-waste-it-must-tackle-soaring-plastic-production-and-why-we-use-so-much-of-it-179107
- Velasco-Herrejón, Paola, Thomas Bauwens, and Martin Calisto Friant. (2022) Challenging dominant sustainability worldviews on the energy transition: Lessons from Indigenous communities in Mexico and a plea for pluriversal technologies. *World Development* 150: 105725. https://doi.org/10.1016/j.worlddev.2021.105725

- Calisto Friant, Martin (2021) The Circular Economy: Societal Transformation or Economic Fairytale? *Revolve Magazine* (November 2021) https://revolve.media/the-circular-economy-societal-transformation-or-economic-fairytale
- Calisto Friant, Martin (2020) The circular economy: transformative vision or oxymoronic illusion? *Circular Conversations*. (December 2020) https://www.circularconversations.com/research-series-young-researchers/the-circular-economy-transformative-vision-or-oxymoronic-illusion
- Calisto Friant, Martin (2019) Deliberating for sustainability: lessons from the Porto Alegre experiment with participatory budgeting. *International Journal of Urban Sustainable Development* 11(1): 81-99. https://doi.org/10.1080/19463138.2019.1570219

Videos connected to this thesis

The following videos were made in the context of this research, they resume research findings or record specific presentations, conferences or events.

- Three Inconvenient Truths About Circular Economy #1: It is about more than just economy (December 2021): https://youtu.be/FaipZCzSvj0
- From a circular economy to a circular society: evolution of the circularity debate, talk at the 2nd Online Utrecht Degrowth Symposium (15 May 2020): https://youtu.be/cL-b7V7MEE4
- Circular Society Forum 2021: Building Blocks Of A Circular Society with Martin Calisto Friant and Melanie Jaeger-Erben (February 2021): https://youtu.be/BKknWZr35Ao
- Anticipatory Governance Webinar 12 - A Critical Discussion on the Diverse Discourses of Circular Economy and Society (May 2021): https://youtu.be/3QxJ8_PYk20
- Consulting Without Borders 2022: Degrowth (February 2022): https://youtu.be/Iukw9SXVUn4
- Ontgroei at InVirolution festival 2020: https://www.youtube.com/watch?v=FwGI8uVkO5U

Summary

The Circular Economy (CE) has recently become a popular concept in sustainability discourses for both the public and private sectors. The proponents of this idea often espouse many social, economic, and environmental benefits from the application of CE practices. Given current socio-ecological challenges to overcome resource scarcity, climate change, and biodiversity loss, all while reducing global poverty and inequality, the CE could provide key solutions and opportunities for a transition to a sustainable, fair, and resilient future.

However, the CE faces many limitations to deliver on those expectations. The CE is very much a contested concept in the sustainability discourse with many actors proposing different visions of a circular future based on their particular socio-economic interests. Moreover, the economic, social, political, and environmental implications of different circular discourses and policies remain poorly researched and understood.

This thesis addresses this research gap by answering the following question: what are the main societal discourses and policies on the CE, how can they be critically analysed, compared, and understood, and what are their sustainability implications? To answer this question, this thesis uses an interdisciplinary mixed-method approach including critical literature review, content analysis, text-mining, and Q-method survey. The case studies are European Union CE policies, Dutch CE policies for plastics and tyres as well as the CE action plans of Amsterdam, Copenhagen and Glasgow.

Results demonstrate the existence of a plurality of circularity discourses through history, which can be divided based on two main criteria. First, whether they are *sceptical* or *optimist* regarding the possibility of eco-economic decoupling, and second, whether they are *holistic* by including social justice concerns or have a *segmented* focus on resource-efficiency alone. This leads to 4 core discourse types: Reformist Circular Society (*optimist* and *holistic*), Technocentric Circular Economy (*optimist* and *segmented*), Transformational Circular Society (*sceptical* and *holistic*), and Fortress Circular Economy (*sceptical* and *segmented*).

Results from the selected case studies conclude that, although the CE discursive landscape is quite diverse, current policies focus on technical solutions and business innovations which do not address the manyfold social and political implications of a circular future. A technocentric CE approach is thus prevalent in the policies of the EU, the Dutch Government, and the city of Copenhagen. Results also find that the cities of Amsterdam and Glasgow, have a more holistic approach to CE, by acknowledging many social justice considerations. Yet the policies of these two cities remain limited in both their redistributive nature and their transformative potential. Moreover, results demonstrate that all the above case studies follow a growth-optimist approach, seeking to improve economic competitiveness and innovation to decouple economic growth from environmental degradation. However, this approach has key scientific limitations, as research has shown that absolute eco-economic decoupling is neither happening nor likely to happen on a relevant scale to prevent climate change and biodiversity collapse.

This thesis's research has also found that academics and social movements from the Global North and South alike have developed a wide range of alternatives to the growth-centric approach to circularity, such as steady state economics, degrowth, voluntary simplicity, ecological swaraj, economy for the common good, permacircular economy, doughnut economics, buen vivir, and ubuntu. All these alternative discourses can be grouped under the umbrella concept of a circular society. Circular society discourses are united in their objective to create a democratic, fair and sustainable socio-ecological system, which works in harmony with the natural cycles of the biosphere to improve human and planetary wellbeing for current and future generations. More pluralism and inclusiveness of these alternative approaches in the debate surrounding circularity could help co-design and implement sustainable circularity policies, which subordinate economic growth to ecological limits, planetary boundaries and social imperatives. This is key to ensure the political legitimacy, social relevance and scientific validity of the circularity policies that are implemented to create a fair, sustainable, and democratic circular society.

Keywords: Circular economy, circular society, policy analysis, discourse analysis, sustainability, environmental governance, pluriverse, degrowth.

Samenvatting

De Circulaire Economie (CE) is recentelijk een populair concept geworden in het duurzaamheidsdebat, zowel in de publieke als de private sector. Voorstanders van dit idee hebben het vaak over de vele sociale, economische en milieuvoordelen die de toepassing van CE-praktijken te realiseren zijn. Gezien de huidige socio-ecologische uitdagingen om de schaarste aan hulpbronnen, klimaatverandering en biodiversiteitsverlies te overwinnen en tegelijk armoede en ongelijkheid in de wereld terug te dringen, zou de CE cruciale oplossingen en kansen kunnen bieden voor een transitie naar een duurzame, eerlijke en veerkrachtige toekomst.

De CE kent echter te veel beperkingen om aan deze verwachtingen te voldoen. Het is een omstreden concept in het debat rond duurzaamheid, waarbij actoren verschillende visies op een circulaire toekomst hebben, mede op basis van hun specifieke sociaal-economische belangen. Bovendien zijn de economische, sociale, politieke en milieu-implicaties van verschillende circulaire narratieven en beleidsmaatregelen nog niet genoeg onderzocht en begrepen.

Dit proefschrift richt zich op deze kloof in bestaand onderzoek door de volgende vraag te beantwoorden: wat zijn de belangrijkste maatschappelijke narratieven en beleidsmaatregelen over de CE; hoe kunnen deze kritisch geanalyseerd, vergeleken en begrepen worden; en wat zijn hun duurzaamheidsimplicaties? Om deze vraag te beantwoorden gebruiken we een interdisciplinaire mixed-method benadering, inclusief kritisch literatuuronderzoek, inhoudsanalyse, text-mining, en Q-method onderzoek. De casestudies betreffen het CE-beleid van de Europese Unie, het Nederlandse CE-beleid voor kunststoffen en banden, en de CE-actieplannen van Amsterdam, Kopenhagen en Glasgow.

De resultaten tonen aan dat er in de loop van de tijd een diversiteit van circulariteitsnarratieven is ontstaan. Deze kunnen worden onderverdeeld op basis van twee hoofdcriteria: ten eerste of ze *sceptisch* of *optimistisch* zijn ten opzichte van de mogelijkheid tot ontkoppeling van milieuschade en economische groei, en ten tweede of ze *holistisch* zijn door ook aandacht te besteden aan sociale rechtvaardigheid, dan wel een *gesegmenteerde* focus hebben enkel op efficiënt gebruik van grondstoffen. Dit leidt tot vier hoofdtypen narratieven: Reformistische Circulaire Samenleving *(optimistisch en holistisch)*, Technocentrische Circulaire Economie *(optimistisch en gesegmenteerd)*, Transformatieve Circulaire Samenleving *(sceptisch en holistisch)*, en Fort Circulaire Economie *(sceptisch en gesegmenteerd)*.

Resultaten van de geselecteerde casestudies laten zien dat, hoewel het discursieve landschap rond CE behoorlijk divers is, het huidige beleid zich vooral richt op technocratische oplossingen en bedrijfsinnovaties, die niet ingaan op de vele sociale en politieke implicaties van een circulaire toekomst. In het beleid van de EU, de Nederlandse regering en de stad Kopenhagen overheerst een technocentrische CE-benadering. De resultaten laten ook zien dat Amsterdam en Glasgow een meer holistische benadering van CE hebben, doordat

ze vele sociale rechtvaardigheidsoverwegingen meewegen. Toch blijft het beleid van deze twee steden beperkt, zowel in de herverdeling van welvaart als in hun transformatief potentieel. Bovendien blijkt uit de resultaten van alle casestudies dat men een groei-optimistische benadering volgt, waarbij wordt gestreefd naar verbetering van het economisch concurrentievermogen en innovatie om economische groei los te koppelen van milieu-impact. Deze benadering heeft echter belangrijke wetenschappelijke beperkingen, aangezien uit onderzoek is gebleken dat absolute ontkoppeling van milieu en economie niet plaatsvindt en waarschijnlijk ook niet zal plaatsvinden op een schaal die voldoende is om klimaatverandering en massaal biodiversiteitsverlies te voorkomen.

Het onderzoek van dit proefschrift heeft ook aangetoond dat dat academici en sociale bewegingen uit zowel het Mondiale Noorden als het Mondiale Zuiden een breed scala aan alternatieven hebben ontwikkeld voor de op groei gerichte benadering van circulariteit: zoals in pleidooien voor steady state economics, degrowth, voluntary simplicity, ecological swaraj, economy for the common good, permacircular economy, doughnut economics, buen vivir, en ubuntu. Concepten van de circulaire samenleving zijn verenigd in hun doel om een democratisch, eerlijk en duurzaam sociaal-ecologisch systeem te creëren, dat in harmonie werkt met de natuurlijke cycli van de biosfeer om het welzijn van mens en planeet voor huidige en toekomstige generaties te verbeteren. Meer pluralisme en inclusiviteit van deze alternatieve benaderingen in het debat rond circulariteit zou kunnen helpen bij het samen ontwerpen en implementeren van duurzaam circulariteitsbeleid, dat economische groei ondergeschikt maakt aan ecologische grenzen, planetaire grenzen en sociale imperatieven. Dit is essentieel om de politieke legitimiteit, sociale relevantie en wetenschappelijke validiteit te waarborgen van het circulariteitsbeleid dat wordt uitgevoerd om een eerlijke, duurzame en democratische circulaire samenleving te creëren.

Trefwoorden: circulaire economie, circulaire samenleving, beleidsanalyse, discoursanalyse, duurzaamheid, milieubeheer, pluriversum, degrowth.

Acknowledgments

It is impossible to acknowledge and thank everyone that contributed to this thesis, from the many interviewees and survey respondents to the anonymous reviewers of each paper and the countless conversations I've had with friends, students, and colleagues throughout these 4 years. I am extremely grateful to my supervisors, Walter and Roberta who believed in me from the very first online interview and kept supporting and encouraging me to improve my research throughout these 4 years. Thanks also to Ernst, my secondary supervisor, who brought invaluable contributions to this research with his comments, suggestions, and edits to this thesis. I am also grateful to all the CRESTING team, what an inspiring and engaging group of supervisors and PhD students. The countless meetings, workshops, conferences, events, and connections we built transformed the somewhat solitary nature of the PhD into a real convivial experience. I am particularly grateful to Kaustubh and Kieran, my two fellow ESRs that shared this whole experience with me in Utrecht and became as dear as family to me. I could not dream of a better way to do a PhD. I am also grateful to all the team at the Copernicus Institute of Sustainable Development, particularly Peppi, Dirkjan, and Katie, the Masters students that worked with me in the various chapters of this thesis. It was a real pleasure to teach and learn from such inspiring young researchers.

I am also deeply grateful to my other colleagues, especially those of the governance group, of the unmaking project led by Giuseppe Feola and of the Urban Future Studio team led by Maarten Hajer. Giuseppe's team brought a breath of fresh air to the office, that inspired countless ideas and discussions in the "degrowth" section of the institute. They introduced me to Ontgroei, the Dutch degrowth platform, and together with Olga, Laura, Giuseppe and Sanli, we co-organized the second online degrowth symposium where some of this thesis research was presented. Learning and collaborating with Gerrit, Crelis, Julien, Federico, Wendy, and the many other members of Ontgroei has been immensely valuable to me, as I found with them an academic, intellectual and activist community that I truly believe in. In a sustainability field, that I often found elitist, and lacking societal relevance, they were a light that reminded me that there is another, more critical, radical, and deeply democratic way to see science and create and share knowledge.

I would also like to thank all the people with whom I collaborated during my PhD, and those who contributed to this thesis in one way or another, especially Soren, Melanie, Federico, Oona, Thomas, Paola, Roelf, Jacob, Juil, Denise, Kiyokazu, Yu, Sabrina, Kasper, Piero, Oscal, Anke, Emmanuel-Benoit, Jeroen, Anya, Ralph, Keith, Anna, Natacha, Tomas, Santi, Anna, Estephania, Dimitri, Erik, Blake, and Marcus. I have found with them not only countless insights, as well as inspirations for new publications, initiatives, conferences, and projects throughout these years, but also new and valuable friendships.

Working and living and doing a PhD in a new country and having to go through a pandemic takes a lot of care. And I found in Tammy, my wife, friend, lover, and partner, all the care that I needed to keep my head high and my heart going. I am immensely grateful to her, she gave me the courage to apply to this PhD project in the first place and stayed by my side through the ups and downs of life, keeping me motivated and inspired to continue throughout. My family has also been a constant source of support and motivation in these times, especially my mother and father. They shaped and made me, without the example, education and care they gave me, I wouldn't be here today. I am also grateful to Coco and D'Artagnan, my two feline friends, roommates, and companions. I can barely go through a day without their cuddles and purrs, let alone an entire PhD.

Finally, there is no way to express the gratitude I have for the many new friends I have made in these 4 years. Kaustubh, Kieran, Thomas, Adam, Damian, Nico, Oksana, Anna, Laisvie, Kos, and many more have brought countless movements of laughter, joy and care, which helped me through the ups and downs of life and through the lockdowns imposed by the Covid-19 pandemic. Living far from family and from home is always a challenge, but thanks to these new friends, I found a new family and a new home in the Netherlands.

This PhD is nothing more than a fruit of the many encounters, friends, teachers, and conversations I've been lucky to have through the years. I can't possibly mention everyone here but I'm immensely grateful to all of you for all the shared memories, thoughts, ideas, and discussions. Whatever is written here, is just as much a product of your ideas than of my own.

Finally, if this thesis can be dedicated to anyone, it is to the over 200 human and environmental rights defenders who give their lives every year and pay the ultimate price while fighting for a better world for all of us. This thesis is no way near as brave and impactful as their actions, but it humbly shares their goal for a better tomorrow, and it is gratefully dedicated to their fight, their courage, and their struggle. May their memory and legacy keep guiding us in our search for a brighter, fairer, and more sustainable future.

About the author

Martin Calisto Friant has an interdisciplinary academic background in international development studies, political ecology, environmental governance, and urban planning from McGill University (BA), the University of Melbourne (MA), and University College London (MSc). Before starting his PhD at Utrecht University, he worked as a sustainability practitioner for various NGOs, inter-governmental organizations, and public institutions and participated in projects in Africa, Europe, Oceania and North and South America.

Research context

This research was one of 15 individual research projects, all involved in an Horizon2020 ITN research programme called Cresting. The Cresting project looked at the broad sustainability implications of the CE. This included five distinct work packages, which examined current practices and discourses, corporate engagement, public sector engagement, capturing the benefits of CE and measure the impacts of CE. These projects were spread across 8 European universities, with partners in Nigeria and China. The PhDs were partnered with two or three universities, with which they held research visits. During the three years of the project, meetings and trainings were held in Hull, Utrecht, Lisbon, Troyes, Graz (online) and Pescara (online). This diversity of project partners, institutors and experiences have allowed the project and researchers to benefit from a diverse and interdisciplinary array of perspectives.

The Cresting Early Stage Researchers and supervisors Pauline Deutz and Andy Jonas at the first Cresting meeting in Hull, September 2018.

This thesis seeks to understand and map the main circular economy (CE) discourses and policies and analyse their core economic, social, political, and environmental implications.

Results demonstrate that mainstream CE practices focus on technological solutions and business model innovations which do not address the manyfold social and political implications of a circular future. A growth-optimist approach to CE is thus prevalent which seeks to improve technological competitiveness and innovation to decouple economic growth from environmental degradation. However, this approach has key limitations as scientific research has shown that decoupling is neither happening nor likely to happen on a relevant scale to prevent climate breakdown and biodiversity collapse.

This thesis's research has also found that academics and social movements from the Global North and South alike have developed a wide range of alternatives to the growth-centric approach to circularity, such as steady state economics, degrowth, voluntary simplicity, ecological swaraj, economy for the common good, permacircular economy, doughnut economics, buen vivir, and ubuntu. All these alternative discourses can be grouped under the umbrella concept of a circular society. Circular society discourses are united in their objective to create a democratic, fair and sustainable socio-ecological system, which works in harmony with the natural cycles of the biosphere to improve human and planetary wellbeing for current and future generations.

Greater inclusiveness of these alternative approaches in the debate surrounding circularity could help co-design and implement sustainable circularity policies, which subordinate economic growth to ecological limits, planetary boundaries and social imperatives.