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Critical analysis of Circular Economy policies and discourses in different European Cities: Case study of Amsterdam and Glasgow

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Executive Summary

Cities play a key role in driving and sustaining the unsustainable production and consumption patterns that permeate society at the expense of the planet and human wellbeing. This problem can be addressed in cities through the transition to a Circular Economy (CE). The CE is an ill-defined concept, thus, there are various understandings of what the CE entails and envisions. A common approach to CE, followed by practitioners and some academics, are technocratic depoliticised eco-modernist visions geared towards resolving the tension between economic growth and scarcity of resources. However, these visions limit the potential of CE to offer alternatives that fundamentally question not only how and why we produce and consume but, also, who controls and owns these processes and how are particular groups in society advantaged or disadvantaged. This is key for a truly sustainable and equitable future. So, now that the CE is being advanced at the city level it is crucial that how the CE is implemented is critically analysed and the variety of visions present is explored.

This research then aimed to investigate the plurality of CE policies and discourses that are advanced by different European cities (Amsterdam and Glasgow) and identify how these policies and discourses can be critically analysed. To explore alternative circular visions and pathways present in cities, this research developed a policy-discourse framework, which connects circularity policies proposed at the city level to the four circularity discourse types identified and created by Calisto Friant et al. (2020). This framework was then tested through two pilot case studies (Amsterdam and Glasgow), in combination with a document analysis, to critically analyse and compare the respective city's CE strategies.

Overall, the research found that RCS and TCE discourse are prevalent in both Amsterdam and Glasgow's CE strategies. However, there were discrepancies between what was said in the policy document and what was being done in practice, with policies inadequately addressing socio-ecological issues despite each city's socially progressive visions. Based on these findings, the conceptual and potential implications of the policies and discourses were discussed, including, the problematic assumptions behind decoupling and the need for participatory governance structures in cities. Subsequently, recommendations for improvement were provided.

Keywords: Discourse, Circular Economy, Cities, Governance, Europe

Preface

From an early age, having grown up in a beautiful country such as Scotland, I have developed a strong moral obligation to care and protect both the planet and its people. This moral obligation and drive to contribute towards a better world developed during my undergraduate degree in Geography, where I became aware of how political and economic systems create and exacerbate inequalities and the ecological crisis. Consequently, I have become interested in thinking about different types of futures and what alternative economic and political systems are possible. Carrying out my thesis on the Circular Economy in cities, with its various meanings and visions, then, appealed to this interest.

This thesis was carried out in cooperation with Martin Calisto Friant and supervised by Dr. Walter Vermeulen to explore how Circular Economy policies and discourses are advanced in different European Cities and how they can be critically analysed. A key element of this research is the development of the policy-discourse framework which we hope, in the future, can be used by practitioners to explore how circularity is being implemented in their own cities and what policy options are available. The results of the analysis provide a fruitful insight into how CE is being implemented and advanced in Amsterdam and Glasgow, and key lessons and reflections are provided in the discussion which note how both cities can improve.

1. Introduction

The earth's ecological systems are being degraded at an alarming rate, with research suggesting that if current trends such as resource depletion, excessive land use, and biodiversity loss continue, the earth's regenerative carrying capacity will be compromised, posing an existential threat to our existence (Rockström et al., 2009). Globally, consumption rates have increased eightfold in the past 100 years and is expected to triple by 2050 (Prendeville et al., 2018). This growing and overwhelming demand for and consumption of natural resources contributes significantly to environmental change and is intricately tied to our linear economic model (Savini, 2019). The model follows a make-use-dispose system which, at its most basic level, virgin materials are extracted, produced, used and discarded based on the assumption of limitless economic growth (Savini, 2019; Reike et al., 2018).

Material consumption and production are particularly pertinent for cities, which are considered world engines of economic growth, generating around 70% of global GDP (Paiho et al., 2020). Currently, cities consume approximately 60-80% of global natural resources, produce 50% of global waste and 75% of greenhouse gas emissions (Williams, 2019), and as urban populations are expected to increase in the future, these figures will only continue to grow. Furthermore, cities also face various socio-economic issues such as income inequality, social injustice, unemployment, financial austerity, and housing and transport issues (Kisser & Wirth, 2021; Williams, 2021). Therefore, efforts must be taken to tackle our unsustainable production and consumption patterns, particularly within cities, by adopting a long-term view that interconnects environmental protection and societal concerns with economic well-being (Vermeulen, 2015)

One method of tackling the environmental and socio-economic challenges in cities, is through the transition to a Circular Economy (CE). CE as a concept is ambiguous, ill-defined and contested concept (Lazarevic & Valve, 2017) and despite increasing attention within academia in recent years, it is still under construction and interrogation (Calisto Friant et al., 2020). Consequently, how the transition towards a CE should be achieved is uncertain and unclear.

CE has existed for a while within public policy circles, with actors mainly in the private sector and government defining and developing the discourse and principles concerning CE (Korhonen et al., 2018). The mainstream rationale behind CE, followed by the national governments and business actors, (Calisto Friant et al., 2020), is that it will create positive change concerning the way society assesses the value and use of natural and material resources by decoupling economic activity from resource use through closing energy and material loops and thereby contributing to sustainable development (Geissdoerfer et al., 2017; Gregson et al., 2015). This technocratic depoliticised eco-modernist vision of CE (Kębłowski et al., 2020; Ortega Alvarado et al., 2021) limits the potential of CE to offer alternatives that question not only how and why we produce and consume but, also, who controls and owns these processes and how particular groups in society are advantaged or disadvantaged, which is key for a truly sustainable and equitable future.

We have now seen interest in the transition to CE at the city level, with stakeholders in diverse urban contexts discussing their goals to go circular quickly and the desire to become a leading circular city (Kębłowski et al., 2020; Petit-Boix & Leipold, 2018). Advocates such as the Ellen MacArthur Foundation (EMF) and various scholars argue that cities are particularly well-placed to support the CE due to their high concentrations of capital, talent and resources, and the capacity of local governments to implement meaningful transitions towards sustainability (Ellen MacArthur Foundation, 2017; Bolger & Doyon, 2019; Ghisellini et al., 2016). Consequently, cities are developing broad strategies for going circular or identifying specific circular measures, for example, stimulating innovative product design to increase recycling, repair cafes in local neighbourhoods and/or the reuse of organic waste as a source of energy (Reike et al., 2018; Savini, 2019).

As the dominant vision of CE among societal stakeholders is rather technocentric, there is the need to question and analyse the discourses promoted by 'circular' policies, as they are articulated in specific urban contexts. In doing so, academics and stakeholders alike can better explore alternative circular visions and pathways for their cities.

Now that CE is being carried out at the city level, their policies and respective discourse tend to differ in their focus and scope, and these facets have not been well researched. The research that has been carried out thus far concerning CE and cities has analysed and addressed how the CE can be achieved in cities;

namely, what opportunities and barriers exist in the implementation of policies, how to monitor and evaluate their progress and the role of different actors in the transition to CE (e.g., (Bolger & Doyon, 2019; Campbell-Johnston et al., 2019; Prendeville et al., 2018)). However, there is little research on how circular policies and discourses at the city level can be critically and systematically analysed. Thus, this research will address this concern, and fill the knowledge gap.

This research focused on European cities. CE has been predominantly included within the urban strategies of European cities in comparison to other areas around the world (Savini, 2019), and as they are in the global north, consumption rates are significantly higher than in the global south. Thus, the implementation of CE or similar sustainability strategies is crucial.

1.1. Research questions and objectives

This research had two main objectives. First, it aimed to investigate and analyse the plurality of CE policies and discourses that are advanced by different European cities to explore alternative circular visions and pathways. Second, it aimed to identify how city CE policies and discourses can be critically analysed. These objectives were achieved by carrying out an academic literature review and building upon the CE discourse typology by Calisto Friant et al. (2020) to develop a CE policy-discourse framework. This framework acts as the analytical tool to explore and compare how CE manifests in different cities. Further, it helps to identify the conceptual and practical implications of the policies and discourses in tackling unsustainable consumption, production, and sustainability more broadly. From these findings, policy recommendations and key lessons will be provided.

The main research question is as follows:

What circularity policies and discourses are advanced by different European cities, and how can they be critically analysed?

From this question, the following sub-research questions have been identified:

1. What circularity policies and discourses at the city level are analysed in the academic literature?
2. How can the plurality of policies and discourses be critically and systematically analysed?
3. What circularity policies and discourses are promoted by different European cities?
4. What governance modes and mechanisms are used by different European cities to develop and implement circularity policies?
5. What are the conceptual and practical implications of the circularity policies and discourses?

2. Theoretical Background

2.1. Circular Economy discourse(s)

2.1.1. Policy discourse analysis

The thesis takes a constructivist approach to policy, not regarding the problems and solutions stated within policies as a given. Discourses are important and condition how we define, interpret, and address environmental issues (Dryzek, 2013) and can generally be defined 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” (Hajer & Versteeg, 2005, p.175). They enable and constrain how political actors and society understand and act on particular physical or social phenomena discussed within environmental policymaking (Leipold et al., 2019), shaping what can and cannot be thought and what range of policy options are possible (Hajer & Versteeg, 2005). Various discourses exist at one point in time; however, they often compete with one another, with one or a few discourses dominating whilst others are suppressed. Discourses are thus rooted in politics and power (Hajer & Versteeg, 2005; Leipold et al., 2019).

2.1.2. Circular economy origins and conceptualisation

The CE is a collection of conceptual responses to our unsustainable linear system that has influenced the socio-economic landscape since the industrial revolution (Clube & Tennant, 2020; Geissdoerfer et al., 2017). Theories underpinning the conceptualisation of CE have existed since the 1960s, with roots in the environmental and ecological economics, industrial ecology, and corporate sustainability literature, for example, and precursors such as limits to growth, small is beautiful and ecological design, for instance. (Bauwens et al., 2020; Calisto Friant et al., 2020; Gregson et al., 2015; Lazarevic & Valve, 2017). Indeed, the concept has emerged gradually over time in different stages, stimulating a shift in its conceptualisation and relationship with sustainability (Reike et al., 2018).

Between the 1970s and 1990s, CE 1.0 emerged and focussed predominantly on dealing with waste, with the emergence of the 3Rs of reduce, reuse, and recycle. Waste management was important means of regulating landfill, however, there was a lack of systemic thinking, with waste being disposed with or dumped across borders in global south countries (Reike et al., 2018). Thus, what emerged as a rise in scholarly work and thinking that put systems thinking approaches at the centre (e.g., industrial ecology and cleaner production).

Second, between the 1990 and 2010s, CE 2.0 emerged and increased attention was given to questions of prevention and efficiency through design, drawing predominantly from systemic concepts such as industrial ecology extended product life, cleaner production and industrial metabolism (Calisto Friant et al., 2020; Reike et al., 2018). CE 2.0 generally draws comparisons with the natural energy and material flows

found in ecosystems, arguing that the transition towards sustainable development will occur by closing materials loops via the exchange of by-products and waste. In doing so, economies will transition from being linear to circular. (Gregson et al., 2015).

Lastly, CE 3.0 emerged and took stage in the 2010s and began to take a comprehensive socio-economic approach to production and consumption (Calisto Friant et al., 2020). There was still a focus on economic growth and efficiency, however, there was also a realisation that we cannot consume endlessly, developing the idea that within CE, economic growth can be decoupled from resource use (known as CE 3.1) (Reike et al., 2018). Here emerged concepts such as cradle to cradle and natural capitalism. There was also thinking that emerged (known as CE 3.2) that took seriously societal concerns such as creating fair and democratic systems and recognised that eco-economic decoupling is impossible and, therefore capitalism, as an economic system, is unsustainable (Calisto Friant et al., 2020). Associated concepts such as degrowth, permaculture and transition design, for example recognised the wholesale need to transform our economic systems with a level of scepticism concerning about the ability to protect the planet from ecological collapse within the constraints of the capitalist system (Calisto Friant et al., 2020; Reike et al., 2018).

Within the academic literature, the CE can be operationalised according to the CE value retention hierarchy, which represents the various ways of dealing with the waste products and materials (Reike et al., 2018). The value retention hierarchy has 10R's that are ranked from the shortest loop to the longest loop: 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. Generally, CE 1.0 & 2.0 focuses on the larger loops of the value retention hierarchy (R4-R9) and is thus more concerned with dealing with waste than changing consumption patterns. In comparison CE 3.1 and 3.2 predominantly deal with the intermediate (R2-R7) and shorter loops (R0-R6) of the value retention hierarchy, focussing more on preventing overconsumption and the creation of waste itself (Reike et al., 2018).

The differences in conceptualisation between CE 1.0-3.0 illustrate the evolutionary nature and diversity of CE. The understanding of CE, most commonly cited in practitioners and academics' debate, follows CE 2.0 definitions and conceptualisation (Korhonen et al., 2018). However, CE 2.0 does not fundamentally question or address the root causes of the sustainability issues at hand and neglects to address social and political concerns, limiting its effectiveness for inciting systemic change (Hobson & Lynch, 2016; Marin & de Meulder, 2018).

2.1.3. Circular Economy discourse typology

Based on extensive CE research and its related concepts, Calisto Friant et al. (2020) developed a CE discourse typology to better evaluate, understand, and navigate various CE visions and understandings. This typology is built upon in this research to create an analytical tool for which the plurality of CE policies and the associated discourses at the city level can be critically analysed and compared.

CE discourses differ depending on their view on technological innovation and ecological collapse and the CE's socio-economic, environmental, and political considerations (Calisto Friant et al., 2020). In terms of the approach to technological innovation and ecological collapse, discourses can either be sceptical or optimistic. **Sceptical** discourses believe socio-technological innovations will not prevent ecological collapse through eco-economic decoupling (Calisto Friant et al., 2021). **Optimist** discourses, in comparison, believe that socio-technological innovations will lead to eco-economic decoupling and thus prevent ecological collapse (Calisto Friant et al., 2021). Concerning the CE's socio-economic, environmental, and political considerations, discourses can be segmented or holistic. **Segmented** discourses have a uniform focus on the CE's industrial, technical, and business components to improve resource and material efficiency (Calisto Friant et al., 2021). On the other hand, **holistic** discourses seek to integrate the socio-political implications of the CE and thus also strive for cultural, social, and political change (Calisto Friant et al., 2021). The combinations of these discourses produce four types of circularity thinking: Reformist Circular Society, Technocentric Circular Economy, Transformational Circular Society, and Fortress Circular Economy (Figure 2.1). 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 Economy (Calisto Friant et al., 2020).

		Approach to social, economic, environmental and political considerations	
		Holistic	Segmented
Technological innovation and ecological collapse	Optimist	<p>Reformist Circular Society</p> <ul style="list-style-type: none"> • <i>Assumptions:</i> reformed form of capitalism is compatible with sustainability and socio-technical innovations can enable eco-economic decoupling to prevent ecological collapse. • <i>Goal:</i> economic prosperity and human well-being within the biophysical boundaries of the earth. • <i>Means:</i> technological breakthroughs, social innovations and new business models that improve ecological health, resource security, and material prosperity for all. 	<p>Technocentric Circular Economy</p> <ul style="list-style-type: none"> • <i>Assumptions:</i> capitalism is compatible with sustainability and technological innovation can enable eco-economic decoupling to prevent ecological collapse. • <i>Goal:</i> sustainable human progress and prosperity without negative environmental externalities. • <i>Means:</i> economic innovations, new business models and unprecedented breakthroughs in CE technologies for the closing of resource loops with optimum economic value creation.
	Sceptical	<p>Transformational Circular Society</p> <ul style="list-style-type: none"> • <i>Assumptions:</i> capitalism is incompatible with sustainability and socio-technical innovation cannot bring absolute eco-economic decoupling to prevent ecological collapse. • <i>Goal:</i> a world of conviviality and frugal abundance for all, while fairly distributing the biophysical resources of the earth. • <i>Means:</i> 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. 	<p>Fortress Circular Economy</p> <ul style="list-style-type: none"> • <i>Assumptions:</i> there is no alternative to capitalism and socio-technical innovation cannot bring absolute eco-economic decoupling to prevent ecological collapse. • <i>Goal:</i> maintain geostrategic resource security and earth system stability in global conditions where widespread resource scarcity and human overpopulation cannot provide for all. • <i>Means:</i> innovative technologies and business models combined with rationalized resource use, imposed frugality and strict migration and population controls.

Figure 2.1: Circular discourse typology (Calisto Friant et al., 2020)

Technocentric Circular Economy (TCE)

A Technocentric Circular Economy (optimist and segmented) aims to reconcile the economic and environmental concerns with the expectation that absolute eco-economic decoupling is possible and will prevent potential ecological collapse (Calisto Friant et al., 2020, 2021). To do so, TCE promotes solutions such as industrial symbiosis, extended producer responsibility, remanufacturing, and eco-design, alongside some contentious innovations such as geoengineering, artificial intelligence, and carbon capture storage (Calisto-Friant et al., 2020). As such, this discourse type focuses on the larger loops of the CE value retention hierarchy, in particular, refurbish (R4), remanufacture (R5), repurpose (R6), recycle (R7), recovery energy (R8) and re-mine (R9) (Calisto-Friant et al., 2020).

Reformist Circular Society (RCS)

A Reformist circular society (optimist and holistic) seek a sustainable, fair, democratic, and fruitful future for all in society, achieved through technological advancements, alternative business models and social innovations. They believe that whilst socio-cultural change and greater public participation and inclusion is crucial; change is possible within our current capitalist system. (Calisto-Friant et al., 2020, 2021). Moreover, RCS integrates the three components of sustainability within the discourse and emphasises the need to operate with our planetary boundaries. The types of solutions proposed by RCS discourses include biomimicry, eco-design, material efficiency, product system services, for example. As such, this discourse type focuses on the immediate loops of the CE value retention hierarchy, in particular, reuse (R2), repair (R3), refurbish (R4), remanufacture (R5), repurpose (R6), and recycle (R7) (Calisto-Friant et al., 2020).

Transformational Circular Society (TCS)

A Transformational Circular Society (sceptical and holistic) seeks to reorganise our current societal systems entirely and to democratise and redistribute global power and wealth in order for nature and humanity to exist peacefully together (Calisto-Friant et al., 2020, 2021). This discourse type thus proposes a general economic downscaling or degrowth and follows a philosophy of sufficiency, leading to slower, more convivial, and more meaningful ways of life. The type of solutions proposed by TCS discourses includes emphasis on local production through cooperative and collaborative economic structures, opensource innovation and technologies that will cause no harm to the planet, such as solar panels, wind turbines, 3D printing etc. Furthermore, there is a strong emphasis on fostering greater citizen participation and inclusion in democratic processes, predominantly through bottom-up governance mechanisms (Calisto-Friant et al., 2020). TCS thus focusses mainly on the shorter loops of the CE value retention hierarchy, in particular, refuse (R0), reduce (R1), reuse (R2), repair (R3), refurbish (R4), remanufacture (R5), repurpose (R6) (Calisto-Friant et al., 2020).

Fortress Circular Economy (FCE)

Fortress Circular Economy (sceptical and segmented) a vision of the future in which resources will be scarce and biophysical limits and overpopulation will require substantial cohesive measures. As such, FCE discourses aim to secure natural resources, socio-ecological resilience, economic prosperity and geopolitical power via technological innovation, economic nationalism, and top-down migration control (Calisto-Friant et al., 2020, 2021). Therefore, this discourse type considers solutions across the CE value retention hierarchy, from refuse (R0) to re-mine (R9). Nevertheless, FCE discourses do not deal with questions of social justice or wealth distribution. They are, thus, often criticised as elitist, racist, sexist, and ethnocentric, with white male scientists from the global north imposing sufficiency and limits on communities that have contributed very little to the ecological crisis (Calisto-Friant et al., 2020).

There has been a shift in circularity discourses through time. During the 1960s and 70s, TCS discourses prevailed and there was a solid understanding of planetary limits. Later, during the 1990s and early 2000s, TCE discourses of CE 1.0 and 2.0 dominated, focussing predominantly on the utility of technological innovation and market-based approaches in solving the ecological crisis. Since the early 2010s, RCS and TCS have become more widespread, showing greater concern for the need to address the socio-political dimension of the CE (Calisto-Friant et al., 2020).

2.2. Circular cities

2.2.1. Origins and conceptualisation

Part of the evolutionary shift in CE is its manifestation now at the city level. Similar to CE, there is no distinct definition of a 'circular city', with different framings of circularity in cities leading to different interpretations, agendas and policies (Kębłowski et al., 2020; Marin & de Meulder, 2018). However, despite its popularity amongst governments and policymakers, CE in cities is only starting to be addressed within the academic literature, with scholars now researching and discussing how CE should be understood and operationalised at the city level (Marin & de Meulder, 2018; Turcu & Gillie, 2020).

Circularity within cities, as an operational concept, stems from the analytical concept of urban metabolism (Van den Berghe & Vos, 2019). Whilst urban metabolism is an old concept which is well established in the academic and urban planning communities, within the past two decades, there has been a remarkable resurgence in the concept of 'urban metabolism' due to the increased attentiveness to urbanisation processes within debates around sustainable development (Newell & Cousins, 2015). Scholars deploying the metaphor ascribe various meanings and models to it, however, 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; Kennedy et al., 2007). Traditionally, the concept of urban metabolism facilitated the analysis of material and energy flows within cities, utilising methods such as material flow analysis to quantify the stocks and flows (Newell & Cousins, 2015). This type

of analysis is common the early stages of the transition to CE in cities, with consultancies such as Circle Economy carrying out circular city scans to identify the main waste and material resource streams and thus areas of opportunity.

The concept, however, has also inspired new ways of thinking about how cities can become more sustainable (and circular) and have raised criticism concerning some socio-economic arrangements in which specific types of flows are marginalised and/or prioritised within a city (Castán Broto et al., 2012). Swyngedouw (2015) and Castán Broto et al. (2012) note how urban metabolism can analyse the economic and governance systems that drive the material flows in the city. Who governs urban flows, in particular, is relevant both for how resources are distributed across a city and for the forms of urban organisation that emerge due to the different visions or ideals of what constitutes a good or sustainable city. Thus, it is crucial that socio-economic systems and governance arrangements are critically analysed as well as the material and energy flows.

It is also important to understand what is meant by a city. Like many concepts, cities can be defined in various ways as they are inherently complex systems, with their economies, resources, infrastructures, and networks in which all the different actors and stakeholders are interconnected (Paiho et al., 2020). In their study of six cities in the transition to CE, Predeville et al. (2018) do not define a city, but the paper is concerned with studying administrative and geographical bounded units named and represented by local government officials and policymakers. This research shall take a similar approach to cities.

2.2.2. Circular economy in cities

Stakeholders in various cities such as London, Paris, and Amsterdam are expressing their desire to become circular as quick as possible through the development of broad circular strategies and circular measures (Fratini et al., 2019; Kębłowski et al., 2020; Petit-Boix & Leipold, 2018; Predeville et al., 2018). The growing interest in the CE within cities, however, has not been a natural process. Rather, the ‘buzz’ surrounding the CE has been driven by governments, policymakers, businesses and, in particular, intermediaries such as the EMF. EMF has been particularly influential in the uptake of CE in cities by practitioners and envisions a circular city that “embeds the principles of a circular economy across all its functions, establishing an urban system that is regenerative, accessible and abundant by design” (EMF, 2017, p.9). These principles are predominantly focused on designing out waste and pollution, keeping products and materials in use, and regenerating the natural system, with a win-win solution presented to stakeholders based on decoupling resource use from economic growth (Clube & Tennant, 2020; Giampietro & Funtowicz, 2020). Furthermore, CE has been a key element of the EU’s Urban Agenda, presenting as one of its twelve priority themes and more generally, two action plans have been generated with various policy directives and regulations. Action at the city level is viewed as essential for encouraging all citizens and businesses to adopt circular ways of working and living (European Commission, 2018 cited in Paiho et al., 2020).

There is no one particular way or method for how CE should manifest and be operationalised at the city level, with different framings of circularity in cities leading to different interpretations, agendas and policies (Kębłowski et al., 2020; Marin & de Meulder, 2018). Nevertheless, policymakers and practitioners have embraced the CE discourse in an ‘approbatory, uncritical, descriptive and deeply normative’ way (Gregson et al., 2015, p 218). Circularity seems to be used interchangeably with ‘sustainability, which suggests that the rise of CE in cities may involve the reframing and reclassify of already existing policies rather than actually changing the urban policy agenda (Kębłowski et al., 2020; Predeville et al., 2018). Furthermore, analysis of circular city strategies thus far have found that CE has been framed as a way of creating business opportunities and boosting productivity and competitiveness (Predeville et al., 2018), and there is a lack of consideration of the role of citizens and participatory processes (Fratini et al., 2019; Gravagnuolo et al., 2019; Kębłowski et al., 2020), despite some cities claiming to embrace the socially progressive aspects of the CE.

2.2.3. Opportunities and challenges for cities

With around half of the world's population living in urban areas, cities contribute significantly to complex challenges such as climate change, resource depletion and consumption, environmental degradation, pollution, social exclusion, and health issues (Bonato & Orsini, 2017; Christensen, 2021; UNEP, 2019). However, the global trend in urbanisation may also be utilised and contribute positively to solve various sustainability issues.

The transition towards circularity in cities may provide opportunities for not only solving complex environmental issues but also for helping to tackle various socio-economic issues such as income inequality, social injustice, unemployment, financial austerity, and housing and transport issues (Kisser & Wirth, 2021; Williams, 2021). In her study, Williams (2021) notes the various ecological, economic, and social benefits of circular developments in cities. For example, the potential of looping and ecologically regenerative action to restore the urban ecosystem services crucial for regulating local climate; improve physical and mental health through increased green infrastructure; securing new jobs through the re-localisation of production; and building social and human capital through the operation of community projects such as food cooperatives, sharing hubs and repair cafés. Furthermore, Bassens et al. (2020) note, particularly within the context of the COVID-19 pandemic, the opportunity for the circular transition in cities to go at odds with the neoliberal capitalist growth paradigm, promoting citizen-led solidary-driven initiatives, local production and more inclusive economies.

The transition towards circularity in cities, however, may also pose various challenges and risks. For example, the transition towards CE could potentially exacerbate and reinforce neoliberal urbanism; that is marrying capital accumulation with the increasing ecological challenges at the urban scale (Bassens et al., 2020; While et al., 2004). Moreover, as production tends happen outwith the city boundaries, policies need to be focussed on tackling consumption and the potential rebound effects of increased energy and resource efficiency, for example, need to be considered (Christis et al., 2019). However, research done thus far on CE in cities, has found that actors are generally reluctant to tackle overconsumption in a significant way and as the CE transition in urban contexts are in their early stages, it is difficult to estimate the relationship between certain CE policies and their rebound effects (Kębłowski et al., 2020; Petit-Boix & Leipold, 2018; Predeville et al., 2018).

2.3. Governing the circular economy in cities

Cities act as critical agents of change in the transition towards circularity, with local governments generally holding significant powers in terms of resources and legal competencies in sectors that are relevant for the transition towards a CE, such as energy, transport, waste and water management, urban planning, and economic development (Bulkeley & Betsill, 2005; Christensen, 2021; Puppim De Oliveira et al., 2013). The local government also tend to set the direction of travel by determining the agenda or vision for how a city can become more circular. Predeville et al. (2018) note that senior civil servants are the main actors that set targets and create high-level strategy documents such as CE route maps and strategies. However, to advance the circularity transition, local government must interact with key political, economic and societal stakeholders such as regional and national administrators, investors and private businesses, international agencies, non-governmental organisations (NGOs), and citizens (Bulkeley & Betsill, 2005; Puppim De Oliveira et al., 2013).

2.3.1. Multi-level governance

In an attempt to understand the role of local government as strategic agents of change, scholars have shifted away from a focus on traditional, hierarchical top-down oriented regulation, often labelled 'government', to a focus on non-hierarchical modes of decision-making and coordination between state, market and civil society actors, termed 'governance' (Bulkeley & Kern, 2006; Christensen, 2021; Driessen et al., 2012). The concept of multi-level governance expresses how political authority is dispersed across multiple territorial levels, with state, market and societal actors interacting in both horizontal and vertical directions across local, regional, national, transnational and international levels (Bulkeley & Kern, 2006; Bulkeley et al., 2009; Ehnert et al., 2018). At the horizontal level, knowledge flows and exchanges are made between different city regions, furthered by environmental movements and transnational municipal networks to share ideas, experiences, and knowledge and motivate local action (Lee & Koski, 2015). On the other hand, at the

vertical level, actors attempt to overcome hurdles at their own governance levels by making clever use of negotiation processes at other levels.

Different nations' political systems influence these multi-level governance arrangements. In their research paper, Ehnert et al. (2018) note how different governance contexts – unitary and federal political systems- can affect the dispersion of power between different levels of governance, promoting either power concentration or power-sharing. This can impede or support the ability of local government and stakeholders to advance urban sustainability transitions. For example, with 'hard' power, federal systems disperse power and give actors at different levels of government more opportunity to shape the rules of the game. In comparison, with unitary systems, power is concentrated with central government, making other governance actors more dependent on that political unit (Ehnert et al., 2018). With 'soft' power, defined as the power to share your vision and ideas, provide political support and legitimacy, it is less linked to the configurations of political systems and can be applied by all actors across all levels of governance (Ehnert et al., 2018).

2.3.2. Modes of governance

Bulkeley & Kern (2006), in their study of the role of municipalities in climate change mitigation policy, developed a typology of local governments, whereby different types of action are divided into various modes of governance. Whilst not directly focussed on the CE, the modes of governance identified can be applied to other similar areas of municipal planning, such as the CE.

1. **Self-governance**, defined as the capacity for local government to govern its activities. Within the context of CE, this may involve local government governing and improving the circularity of its activities, for example, through green public procurement, increasing the energy and material efficiency of their real estate etc (Bulkeley & Kern, 2006)
2. **Governing by provision**, defined as governance through the delivery of services and resources. Within the context of CE, this may involve local government, for example, developing district heating systems, improving the quality and sustainability of social housing, grants and subsidies for green roofs, or improving waste infrastructure (Bulkeley et al., 2009; Smedby & Quitzau, 2016)
3. **Governing by authority**, defined as governance through traditional forms of authority, such as economic regulations (tariffs, taxes, sanctions, etc.) and planning laws, improves (the circularity of) private and civil society organisations and influences the actions of citizens.
4. **Governing through enabling**, defined as governance through encouraging, facilitating, coordinating, and collaborating. Local government can facilitate, coordinate, and encourage action via persuasion and negotiation either in the form of incentives or through different types of facilitation and information, for example, supporting community projects, or running promotional activities and campaigns (Smedby & Quitzau, 2016; Voytenko Palgan et al., 2021a). Furthermore, local government can collaborate with state and market actors, civil society organisation and/or other municipalities and cities to advance the CE through, for example, providing information and data, helping to implement private initiatives such as pilot projects, living labs etc. (Christensen, 2021; Puppim De Oliveira et al., 2013).

Bulkeley & Kern (2006) and Smedby & Quitzau (2016) note that while modes of governing may be influenced by national context, there is a general trend of moving towards modes of self-governing and enabling and moving away from governing by authority. This will create specific capacity challenges for local governments in that they will need to develop financial incentives for action, persuade stakeholders and citizens for the need for action, and co-ordinate across various policy areas and arena to establish and foster new governing capacities (Bulkeley et al., 2009; Bulkeley & Kern, 2006; Dagilienė et al., 2021).

3. Methodological Framework

3.1. Research framework

This research involved creating and applying a policy-discourse framework to analyse Amsterdam and Glasgow's various CE policies and discourses. As a result, different visions, and understandings of CE at the city level and the potential implications in terms of sustainability were identified. This was done in several stages and is presented schematically in figure 3.1.

1. A scientific literature review was carried out to gain background knowledge of CE policy and discourse, urban sustainability and cities, and discourse and policy analysis.
2. The research identified what circularity policies are proposed at the city level according to academic literature. Afterwards, the policy-discourse framework was developed using this information, derived from the literature review, to connect circularity policies proposed at the city level and the circularity discourse types identified by Calisto Friant et al. (2020).
3. Amsterdam and Glasgow were selected as the case studies. Then the policy-discourse framework was used to critically analyse and compare the cities' circular policies and discourses, alongside a content analysis of key policy documents and associated literature.
4. The implications of Amsterdam and Glasgow's circular policies and discourses were reflected upon, and recommendations and key lessons were developed. Furthermore, the strengths and weaknesses of the policy-discourse framework within the scope of this research and its future applicability were addressed.

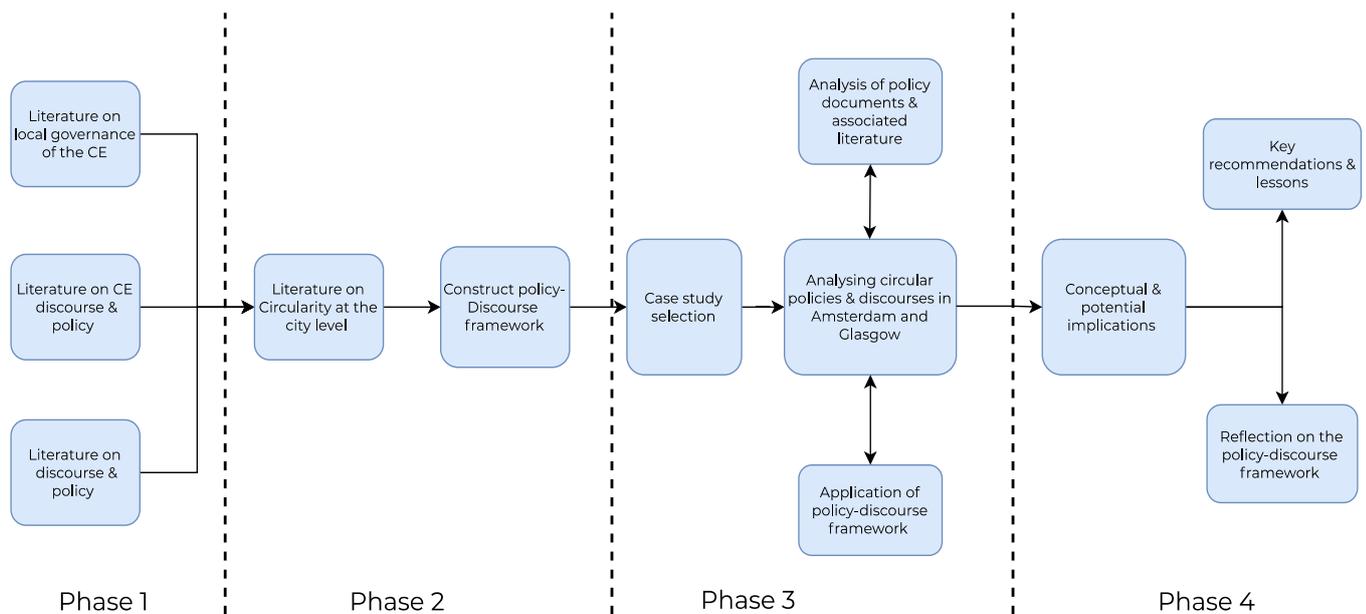


Figure 3.1: Research framework

3.2. Phase 1: Scientific literature review

This research began with a scientific literature review to gain background knowledge and understanding of CE and its application at the city level. In particular, academic articles on CE discourse and circularity in cities were studied. Furthermore, there was a focus on CE literature and work from other related fields such as urban metabolism, urban sustainability, and environmental governance, for example, which had relevant insights for this work. The scientific articles chosen were identified through searches on Scopus, Google Scholar, and the reference lists of key academic articles in the field.

3.3. Phase 2: Constructing the policy-discourse framework

Next, this research adopted a critical stance towards policy, using discourse analysis as a key methodological tool to uncover and analyse the different ideas, interpretations, and understandings of CE within Amsterdam and Glasgow’s route maps/strategies. The discourse analysis was partly carried out through the creation and use of a policy-discourse framework. The framework aims to better understand, describe, and categorise the diversity of CE policies and discourses at the city level, acting as a guide and aiding the comparison of urban CE action plans. Moreover, it aims to review the plurality of possible circular city policies to help academics and practitioners enlarge their understanding of circular policies implementation at the city level.

The framework was built in various stages (Figure 3.2). The first step in building the policy-discourse framework involved identifying what circular policies at the city level are proposed and discussed in academic literature. The search for and selection of the circular policies included in the framework was based not only on what policies are within the means of the municipality (noting differences in power and national conditions) but also on the understanding of CE as an umbrella concept (Homrich et al., 2018) taking into consideration concepts and ideas historically related to CE. Within their paper, Calisto Friant et al. (2020) identified a list of 72 CE-related concepts according to four types of circularity discourses: Technocentric Circular Economy (TCE), Reformist Circular Society (RCS), Transformational Circular Society (TCS) and Fortress Circular Economy (FCE) (Figure 3.2). Concepts were chosen from this list, and how they manifest at the city level, particularly the policies they encouraged or criticised, were identified for the framework. In total, 26 concepts were selected based on relevance and availability of literature across the four types of circularity discourses (see appendix 1), with the number of concepts chosen for each circularity discourse type 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. For each concept, the aim was to review at least 2-3 articles depending on the number of search results, with more articles reviewed for a concept if there were more search results. In total, 88 academic papers and book chapters were reviewed. The majority of the articles were found via Scopus searches. However, where there was a lack of search results, Google Scholar and/or a snowballing technique were used to identify the key papers within the concept fields. The specific search terms used in Scopus to identify articles can be found in table 3.1.

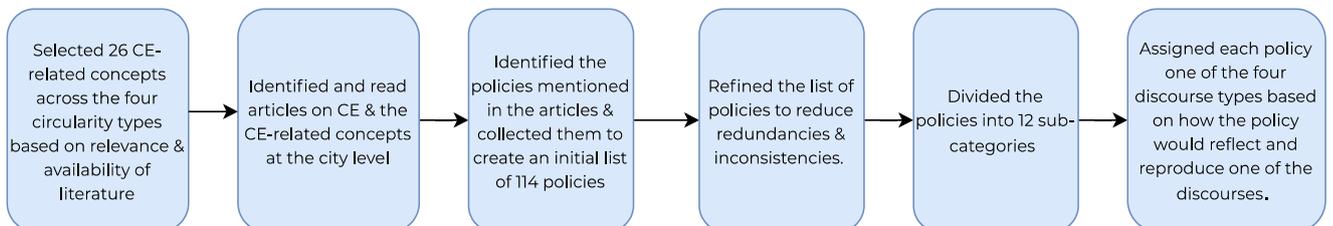


Figure 3.2: Steps in creating the policy-discourse framework

Table 3.1: Search terms used to identify the relevant articles

Search term(s) used	No. of search results on 11/1/2021	No. of articles reviewed
"Circular Economy" AND policy* AND city*	153	17
"Sharing Economy" AND policy* AND city*	91	4
"Cradle to cradle" AND city* OR urban*	36	3
"Natural Capitalism" AND city* OR urban*	6	2
("Regenerative Design" OR "Regenerative City" OR "Regenerative Urbanism" OR "Regenerative Cities") AND (city* OR urban*)	60	3
"Cyclical Economy" AND city* OR urban*	3	1
"The Natural Step" AND city* OR urban*	4	1
"Material Efficiency" AND city* OR urban*	39	2
"Industrial Ecology" AND policy* AND city* OR urban*	128	3
"Biomimicry" AND city* OR urban*	65	3
"Bioeconomy" AND city* OR urban*	64	3
"Industrial Symbiosis" AND policy* AND city* OR urban*	38	2
"Eco-industrial Parks" AND city* OR urban*	93	3
"Product Service Systems" AND policy AND city* OR urban*	12	1
"Cleaner Production" AND policy* AND city* OR urban*	63	3
"Ecofeminism" AND city* OR urban*	28	2
"Deep Ecology" AND city* OR urban*	17	2
"Social Ecology" AND (city* OR urban) AND ("Libertarian Municipalism" OR "Democratic Confederalism" OR "Dialectical Naturalism" OR Bookchin OR policy*)	37	2
("Radical pluralism" OR Pluriverse OR Pluriversal) AND (city* OR urban*)	7	1
"Transition Towns" OR "Transition Town" OR "Transition Movement" AND city* OR urban*	31	4
"Degrowth" AND city* OR urban*	62	6
"Buen Vivir" AND city* OR urban* + Google scholar search for: "Buen Vivir" ciudad* urbano*	19 (+36800)	4
"Permaculture" AND city*	33	3
"Ubuntu" AND policy* AND city* OR urban*	6	1

"Ecological Civilisation" AND policy* AND city* OR urban*	70	3
"Disaster Capitalism" AND city OR urban*	23	6
"Fortress Europe" AND city OR urban*	10	3

Next, the identified policies were organised, categorised, and assigned to one of the four circularity discourses used by Calisto-Friant et al. (2020). First, all the policies identified from the review academic articles were collected, leading to an initial list of 114 different policies. Next, these policies were refined and combined to reduce redundancies and inconsistencies, resulting in a final list of 54 policies, divided into 12 general categories based on the types of policy areas that cities would advance in the transition towards CE (Table 3.2). Subsequently, the identified policies were assigned to one of the four circularity discourse types based predominantly on the extent to which the policy would reflect and reproduce one of the discourses. Discourse types are then not divided equally amongst policy areas as different discursive position would focus on different policy types, for example, TCS policies are most prevalent in the social justice and livelihoods policy area, while TCE policies are most prevalent in the waste management policy area. During this process, there was some uncertainty as particular policies could be aligned to more than one discourse type. However, the categorical imperative thinking “what if this was the only CE policy implemented by the city?” was used when this occurred.

Table 3.2: Policy-areas identified in the literature review

Policy sub-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	7	6	0	1	0
	Water Management	3	2	0	0	0
	Food & Organic Waste Streams	4	1	2	1	0
Built Environment & Spatial Planning	Transport & Mobility	4	1	3	0	0
	Green Buildings	7	3	2	2	0
	Urban Form & Territorial Planning	4	1	1	1	1
	Ecosystems & Nature-Based Solutions	3	1	1	1	0
Socio-political Structure	Economic & Industrial Policy	7	3	0	2	2
	Governance & Municipal Operations	5	3	2	0	0
	Education & Knowledge Development	4	1	2	1	0
	Social Justice & Livelihoods	4	0	1	3	0

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 3.3). However, the framework acts more broadly as a guide in comparing the different CE action plans rather than acting as a strict measuring tool. The rationale for how each policy has been scored can be found in appendix 2.

Table 3.3: Assessment scale for policy-discourse framework

Scale	Explanation
0 = The policy is not mentioned in the CE routemap/strategy	N/A

1 = The policy mentioned in the plan or very little action is taken	No specific or little action is taken. The respective policies are mentioned without subsequent implementation (For example, a city might mention the importance of renewable energies but have no plan or project actually to improve renewable energy generation) or involve carrying out small pilot project(s).
3 = Limited action is taken	Would involve, for example, the city government providing only a small number of resources and support or carrying out several significant research/pilot projects rather than full-fledged commitment with significant financial investments and/or strong regulatory systems.
5 = Strong action is taken	Would entail the city government strongly supporting initiatives ran by itself or by other stakeholders through providing significant financial resources or expertise. It can also involve the city government enacting strict and effective regulatory systems.

As there are an unequal number of policies per discourse type and per policy area in the framework, the strength of the relationship/ commitment to the discourse types and different policy areas was calculated relatively¹ using the following equations to allow for direct comparison:

$$\text{Committment to policy area X (\%)} = \frac{\text{Number of points}}{\text{Total no. of points available in policy area X}} \cdot 100$$

$$\text{Strength of relationship to discourse type X (\%)} = \frac{\text{Number of points}}{\text{Total no. of points available for discourse type X}} \cdot 100$$

Table 3.4: Number of policies per discourse type and total number of points available

Discourse Type	No. of policies	No. of points available
TCE	24	120
RCS	15	75
TCS	12	60
FCE	3	15

Table 3.5: 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
Waste & Material Resource Flows	Renewable Energy	2	10
	Waste Management	7	35
	Water Management	3	15
	Food & Organic Waste Streams	4	20
	Transport & Mobility	4	20

¹ The total number of points available per discourse type and policy area were calculated by multiplying the total points by 5 (the maximum value on the scale). Table 3.4. and 3.5 note the number of policies per discourse type and policy area and the total number of points available.

Built Environment & Spatial Planning	Green Buildings	7	35
	Urban Form & Territorial Planning	4	20
	Ecosystems & Nature-Based Solutions	3	15
Socio-political Structure	Economic & Industrial Policy	7	35
	Governance & Municipal Operations	5	25
	Education & Knowledge Development	4	20
	Social Justice & Livelihoods	4	20

3.4. Phase 3 & 4: Comparative case study analysis

In order to investigate the diversity of circular policies and discourses advanced by different European cities and explore how this diversity can be critically analysed, a comparative case study was used. Case study analysis is a research strategy that allows for a rich and detailed study of a particular problem, phenomenon, or issue (Stewart, 2010) and can demonstrate this across various contexts and circumstances (Mills et al., 2010). This is key as cities are inherently complex and are formed by myriad actors, organisations, and networks (Prendeville et al., 2018). Furthermore, comparative case studies are well suited to developing key policy insights and recommendations and, due to their reflective nature, is supportive of and can help to better understand the connection between the CE policies and discourses advanced by different cities and therefore contribute towards theory development (Stake, 2000; Løkke & Sørensen, 2014).

3.4.1 Case selection

The cases used in this research – Amsterdam and Glasgow - were selected according to established criteria (Table 3.6) based upon the literature review concerning CE and circularity in cities. As one of the research aims was to explore the variety/plurality of circular policies and discourses advanced in different European cities, this research has used a most different case study design. This involved selecting cases based on their differences from each other. For instance, diverse histories or roles (e.g., port vs administrative cities), different political ideologies and/or different levels of wealth. Some cases were excluded from the analysis based on the practicalities of the research. For example, due to language restrictions, only cases with documents in English and access to information were selected.

Table 3.6: Case inclusion criteria

Inclusion criteria	Explanation
Have developed a city level CE strategy, or route map since 2018	Want to study the relevant plans which reflect the new EU package put in place in 2018, which includes new recycling targets and separate collection objectives. Also, to avoid redundancies with previous published research on CE cities.
Have diverse histories or roles, e.g., port, or industrial cities vs political and administrative cities, differing levels of wealth and income equality and/or parties with different political ideologies in power at the municipal/city level.	Generally, the socio-economic conditions and pre-existing institutional and political arrangements influence the circular strategies and visions advanced in cities (Fratini et al., 2019; Kębłowski et al., 2020)
Include a mix of 'best practice' cases and less established or less documented cities	The majority of CE research on cities so far have been concerned with cities that are considered 'front runners' or examples of 'best practice'. The best practice cases will be identified by looking at sustainable city rankings, NGO city rankings, C40 cities and the Ellen McArthur Foundations, and previous academic case study research investigating CE in cities.

3.4.2. Document analysis

The CE strategies and associated policy documents for Amsterdam and Glasgow were reviewed and analysed to establish a critical understanding of the cities' visions of CE, their goals, the problematisations, the policies or strategies included or excluded in the CE plan, and the governance mechanisms at play. A set of questions were derived based on the literature and understanding of the CE discourse typology to analyse the policy documents:

1. How does the city define CE?
2. What are the city's aim and vision (s)?
3. What targets have the city set?
4. What are the problem(s) the city is trying to solve?
5. Who/what are identified as responsible for the problem(s)?
6. What are the main outlined solutions in the city's strategy?
7. What waste/material/resource streams are focussed on in the city's strategy?
8. Who are the stakeholders responsible for implementing the CE strategy, and what are their roles?
9. What opportunities are identified?
10. What policy instruments and modes of governance do the city utilise?
11. Who wrote the CE strategy? What did the process look like?
12. What is the city's perspective on Economic Growth and decoupling?
13. What is their perspective on social and environmental justice?
14. Is there a system for monitoring and evaluating progress?

The relevant documents analysed included the main CE action plans or route maps and other associated documents published by the local city governments or their partners in the initiative (Table 3.7).

Table 3.7: Data sources for policy analysis and policy-discourse framework

Publisher	Date published	Document
City of Amsterdam municipality	2020	Amsterdam Circular 2020-2025 Strategy
	2020	The Amsterdam City Doughnut: A Tool for Transformative Action
	2020	Amsterdam Circular 2020-2025 Innovation and Implementation Programme (<i>Innovatie- en Uitvoeringsprogramma</i>) 2020-2021
	2020	Amsterdam Circular Monitor
Glasgow City Council	2020	Circular Economy Route Map for Glasgow
	2020	Circular Economy Route Map for Glasgow Committee Document

3.5. Reliability and validity of the method

At this stage in the development of the policy-discourse framework, the main aim was to pilot the applicability, effectiveness and validity of the method through the case study analysis. By testing the policy-discourse framework, the research determined how well the framework measures the discourse type and diversity of CE policies possible at the city level i.e., the degree of construct validity (O'Leary-Kelly & Vokurka, 1998). If construct validity is achieved, the policy-discourse framework can be further tested and utilised in the future for further research on CE policy and discourse in cities by both academics and practitioners.

A common criticism of case study analysis is that it has low external validity, i.e., that the findings are difficult to generalise (Mills, Durepos & Wiebe, 2010). However, by studying more than one case, you can ensure some level of certainty that the empirical evidence is aligned with and supports the existing academic literature available (Yin, 2009). The generalisation and reliability of the findings are ensured by taking a systematic approach to the research (Mills, Durepos & Wiebe, 2010). Further, by defining the selection criteria for the case studies in this thesis and the method more broadly, another researcher would be able to carry out the research and would derive similar findings.

4. Policy-discourse framework

4.1. CE-related concepts and their policies at the city level by discourse type

In this chapter, how each CE-related concept operates at the city level and what types of policies they propose is presented and categorised according to the four discourse types.

4.1.1. Technocentric circular economy

Literature on technocentric circular economy concepts focus on developing and utilising new technologies and circular innovations in cities to decouple economic growth from environmental harm. Generally, the policies work to optimise material, energy, and water use, design out waste, green buildings, and make industrial processes more efficient, spanning from R4 (refurbish) to R9 (Re-mine). In particular, there is an emphasis on how by-products of industrial processes and consumer waste can be used to create new products or as an energy source for industrial processes (Cerceanu et al., 2014; Liu et al., 2018). Such processes are made easier due to the geographical proximity of industries and consumers within cities, particularly when they have dedicated eco-industrial parks and enterprise zones (Monaghan et al., 2016; Shah et al., 2020). In addition, collaboration and synergistic opportunities are promoted through economic incentives such as tax cuts and subsidies and/or through the creation of certification schemes and networks for data and resource sharing, auditing, knowledge development and innovation (Belaud et al., 2019; Liu et al., 2018; C. Yu et al., 2015).

A separate sub-group of policies from concepts such as biomimicry and bioeconomy focus on the utilisation of nature-based solutions or innovations inspired by nature, such as green roofs/walls, rainwater harvesting, biodiversity conservation, urban farming/agriculture, and the protection of green belts (Dushkova & Haase, 2020; Schneider et al., 2019; Taylor Buck & While, 2020). Such solutions can be implemented by city governments directly by greening public land and infrastructure or can be implemented by the private sector through incentives such as subsidies, taxes, and regulations (e.g. Spiegelhalter & Arch, 2010; Taylor Buck & While, 2020).

4.1.2. Reformist circular society

Literature on Reformist circular society concepts are focussed mainly on the transition of the city towards socio-economic and environmental sustainability. However, similar to a technocentric circular economy, proponents believe that economic growth can be decoupled from environmental degradation, thus, working comfortably within the capitalist system. There are several sub-categories of policies within this type of circularity thinking. First, some policies generally go further than technocentric policies to include the reuse (R2), repair (R3) and refurbish (R4) of products and services. For example, the promotion of sharing economy activities such as tool libraries, repair centres, food banks, swap shops and second-hand shops (Cohen & Muñoz, 2016; Markendahl et al., 2018). Second, some policies are socially driven, focusing on increasing social cohesion and equality within communities, improving education, and developing more robust democratic structures (Baffour Awuah & Booth, 2014; Hidayat & Stoecker, 2018; McIntyre-Mills, 2020). For example, learning hubs for people to come together and learn new skills, awareness-raising campaigns, shared co-working spaces, and community gardens and centres.

Similar to a technocentric circular economy, finance-based policies are generally used to provide better protection and care for the natural environment both within and outwith the city. For example, resource and pollution taxes, subsidies for green infrastructure projects and nature-based solutions (Schweickart, 2009; Suartika & Cuthbert, 2020). They also encourage greater material efficiency and waste reduction through various means, such as encouraging green and modular design for buildings and encouraging investment in new materials and technological innovations (Du Plessis, 2012; Thomson & Newman, 2018).

4.1.3. Transformational circular society

Transformational circular society concepts are less anthropocentric in their nature and follow a philosophy of sufficiency, placing greater emphasis on the move away from conspicuous consumption. As a result, policies within this circularity thinking focus more on refuse (R0) and reduce (R1) in the consumption of

goods and services. In particular, they attempt to shift thinking beyond western societal notions of 'good living' to prioritise social and ecological well-being (Deng et al., 2012; Latouche, 2016; Shebell & Moser, 2019; White, 2008). This may involve, for example, creating smaller homes, capping household consumption, creating safe and equal access to public (green) spaces, creating local energy co-ops, community gardens and encouraging the use of active and public transport (Crabtree, 2006; A. Ferreira & von Schönfeld, 2020; North & Longhurst, 2013). Moreover, policies that promote the health and harmony between natural and human ecosystems are encouraged, for example, ecological restoration, ecologically adapted design, and rewilding (Hong et al., 2014; Korsunsky, 2019; Wu, 2014).

An essential facet of transformational circular society policies is the emphasis on the local and creating cooperative and collaborative structures that can reduce inequalities and promote a fair distribution of power and wealth. For example, literature in this group suggests a move towards more decentralised and participatory governance structures so that communities can directly govern and meet their needs (Escobar, 2019; Latouche, 2016). Furthermore, policies focus on creating better, more sustainable, and universally accessible public services and amenities, for example, by bringing ownership into public hands and/or creating local cooperatives and currencies which improve local livelihoods by allowing for greater investment back into the community (Beebeejaun, 2017; North & Longhurst, 2013; Taylor, 2012; Zárata et al., 2011).

4.1.4. Fortress circular economy

Fortress circular economy concepts primarily utilise top-down governance structures and privatisation to increase resource efficiency, impose sufficiency and control populations. This is due to an overwhelming concern about global scarcity, which proponents believe should be tackled by tightening borders, particularly between the global North and South, introducing population control measures, and encouraging rational resource use (Calisto Friant et al., 2020; Myambo & Frassinelli, 2019). While this discourse group mainly operates at the national or supranational level, there are many city-level implications. Generally, fortress circular economy policies include efforts to keep resources within the metropolitan area in order to increase resource efficiency and competitiveness. For example, via economic measures such as taxes, deregulation, privatisation and public-private partnerships, the creation of territorial, social, and cultural boundaries and increases in policing (Celata & Coletti, 2016; Ferrer-Gallardo & Albet-Mas, 2013; Myambo & Frassinelli, 2019).

This circularity thinking does not deal with social justice concerns or wealth distribution and is best exemplified by the concept of disaster capitalism (Calisto-Friant et al., 2020). Governments implement policies during times of 'disaster' in the name of 'security' which exacerbate historical legacies of coloniality, inequality, patriarchy, and racism (Long & Rice, 2020). For example, the creation of 'exclusive' urban areas or 'gated' communities, privatising public services, building resilient and defensive infrastructures, and increased investment in the army or defence more broadly (Fu, 2016; Long & Rice, 2020; McBride, 2016). Further, various stakeholders can take advantage of 'disasters' to acquire valuable land once home to marginalised and poor communities, thus, displacing them from their communities. Investors, businesses, and some politicians see the transition towards a greener future as a financial opportunity rather than just an opportunity to protect and improve the livelihoods of the city dwellers (Fletcher, 2019; Long & Rice, 2020).

4.2. Policy-discourse framework

The policy areas in framework can be divided into 3 sub-categories: Waste and Material Resource Flows (Table 4.1), Built Environment and Spatial Planning (Table 4.2) and Socio-political Structure (Table 4.3). The full version of the framework can be found in appendix 3.

Table 4.1. Waste and Material Resource Flows

Policy Area	Policies	Discourse type
Renewable energy	Establishing and/or supporting centralised renewable energy production infrastructure (rooftop solar, wind, geothermal etc.).	TCE
	Promoting decentralised community-owned renewable energy production.	RCS
Waste management	Improving waste separation, collection, processing and recycling infrastructure and processes .	TCE
	Fostering the creation of an efficient secondary materials market through material passports and banks, digital technologies and storage and logistics infrastructure.	TCE
	Establishing incentives to reduce grey (non-recyclable) waste (taxations, pay as you throw structures etc.).	TCE
	Developing and implementing urban mining activities (material and energy recovery from landfills).	TCE
	Banning certain single-use packaging (e.g., shopping bags, takeaway containers, coffee mugs, etc.) and encouraging bulk shopping and reusable containers).	TCS
	Restricting certain single-use packaging (e.g., shopping bags, takeaway containers, coffee mugs, etc.) or replacing them with bio-based and/or compostable ones.	TCE
	Promoting industrial and urban symbiosis and eco-industrial parks for material, nutrient and energy cycling and recovery (e.g., utilisation of excess industrial heat to heat nearby urban areas, waste outputs as industrial inputs etc.).	TCE
Water management	Encouraging the recovery/recycling of wastewater (as fertiliser, energy, bioplastics etc.).	TCE
	Increasing the efficiency of water provision (reducing water leakages, rainwater, and seawater reuse etc.).	TCE
	Creating incentives to reduce water consumption (e.g., incremental fees, quotas. etc.).	TCE
Food and organic waste streams	Promoting urban agriculture , including community-supported agriculture, allotments and community gardens, and the consumption of locally grown food.	RCS
	Promoting household and community composting and bio-digestion of bio-waste through financial support, infrastructure development etc.	TCS
	Establishing centralised bio-waste management systems to recover biomass for fertiliser, biofuel etc. (including separate collection).	TCE
	Encouraging the transition towards more sustainable diets and reducing food waste , for example, through waste prevention campaigns and regulations restricting food disposal.	RCS

Table 4.2. Built Environment and Spatial Planning

Policy Area	Policies	Discourse Type
Transport and mobility	Improving and encouraging shared mobility , such as carpooling, bike-sharing, and car-sharing.	RCS
	Building, improving, and encouraging the use of multi-modal public transport infrastructure (bus, train, tram, metro, BRT, water taxi etc.).	RCS
	Promoting active transport by improving cycling infrastructure, creating pedestrianised areas, and disincentivising motorised transport (e.g., reduced speed zones, speed bumps, traffic lights etc.).	RCS
	Promoting the use of green technologies such as electric cars and autonomous (self-driving) public and semi-private transportation systems (taxis, delivery cars, drones etc.).	TCE
Green Buildings	Setting circular design, construction and material use standards , and regulations to obtain construction permits (energy and water efficiency, use of recovered materials, design for durability, modular design, adaptive construction, design for disassembly, vernacular architecture etc.).	TCE
	Fostering circular recovery of demolition materials (R7) through measures such as strong environmental standards for the handling of demolition waste.	TCE
	Facilitating infrastructure refurbishment , renovation and retrofitting through financial incentives and subsidies to improve energy efficiency and reduce energy bills.	RCS
	Repurposing or renovating old/disused buildings to ensure more efficient use of current building stock, improve energy efficiency , create economic opportunities, and prevent unnecessary demolition/construction.	TCE
	Redistribution and repurposing of old/disused building for social and community purposes to ensure a fairer and more sustainable use of current building stock .	TCS
	Promoting efficient, sustainable, and fair use of current building stock by promoting shared uses such as shared workspaces and co-housing (shared space/facilities such as utility rooms, communal areas, play areas, guestrooms etc.).	RCS
	Reduce per-capita consumption and accumulation of private building stock (e.g., by establishing limits on new housing size (for example, 44m2 per capita or less), banning new single-family housing or banning the ownership of second homes).	TCS
Urban form and territorial planning	Facilitating the creation of exclusive urban territories such as gated communities, shelter-in-place infrastructure, and private bunkers to protect from disasters and conflicts.	FCE
	Encouraging and facilitating neighbourhood development/design centred around public transport nodes and high-density multi-functional spaces (combining housing with shops, services, and public infrastructure) to improve social cohesion and reduce urban environmental footprint (through land use and zoning laws, 20-minute neighbourhood policies, urban re-development projects etc.).	RCS
	Building infrastructure for climate resilience and adaptation (seawalls, levies, dams etc.), including ecosystem-based climate change adaptation and disaster risk reduction (green flood plains, slope greening to reduce landslides, etc.).	TCE
	Fostering urban-rural symbiosis and supporting rural livelihoods (e.g., using waste from urban areas to fertilise soils while providing local food to city inhabitants through farmer's markets etc.).	TCS
Ecosystems and nature-based solutions	Providing ecosystem services by restoring local biodiversity and creating green infrastructure (greening roads and public infrastructure, building parks, transforming parking lots into gardens, creating green roofs and walls etc.).	RCS
	Conserving and protecting biodiversity to increase harmony between social and natural ecosystems (e.g., by capping land artificialisation and the occupation of natural areas, establishing strict protection of green corridors and belts, creating conservation areas, banning mining activities etc.).	TCS
	Establishing payments for ecosystem services (e.g., water conservation through water bill, air quality through congestion charges, etc.).	TCE

Table 4.3. Socio-political Structure

Policy Area	Policies	Discourse Type
Economic and industrial policy	Funding and supporting CE initiatives , entrepreneurs, and start-ups (project grants, subsidies and low-interest loans, tax breaks, enterprise zones, pilot projects, business platforms etc.).	TCE
	Deregulating and liberalising to support innovation and foreign investment in new CE initiatives and businesses.	TCE
	Promoting the local production of goods, shopping at local small businesses and the use of cooperative production structures.	TCS
	Encouraging and creating the capacity for deindustrialisation and local autonomy (traditional labour-intensive production of basic needs such as food, tools, clothing, energy, and housing).	TCS
	Improving eco and material efficiency by promoting and encouraging the use of high-tech communication technologies (smart meters, fiber optics, AI/machine learning, smart LED lighting, automation etc.)	TCE

	Shifting public services to the private sector (housing, water provision, energy etc.) to improve cost-efficiency.	FCE
	Expropriating, dispossessing, and displacing poor communities for economic development (gentrification) or for building infrastructure for disaster risk reduction .	TCE
Governance and municipal operations	Establishing and facilitating participatory mechanisms for the development, governance, and implementation of CE-policies (such as participatory budgeting, referendums, and citizen councils).	RCS
	Establishing and/or facilitating collaborative governance mechanisms with industrial and other actors to improve eco-efficiency (such as Public-Private Partnerships, multi-stakeholder partnerships and extended producer responsibility organisations).	TCE
	Establishing municipal monitoring and evaluation systems , utilising data and information on key material and energy flows (e.g., pollution discharges, traffic flows, industrial symbiosis exchanges).	TCE
	Creating or improving environmental standards on pollution, emissions, energy, and resource efficiency with effective auditing mechanisms .	TCE
	Circular management of public goods and infrastructure through public procurement , public tenders, product-service systems and/or building as a service (for office space, lighting, heating/cooling, communications, electronics, carpeting, cleaning, etc.).	RCS
Education and knowledge development	Establishing and/or supporting communication initiatives for awareness-raising and behavioural change that improve material and resource efficiency (e.g., launching media campaigns or education programmes to improve household sorting of waste).	TCE
	Fostering cultural transformation towards holistic ecological and social worldviews through community-owned media sources, restrictions on advertisements, promotion of non-materialist values and community ethics etc.	TCS
	Establishing and/or supporting training, capacity building and education initiatives to spread the technical skills and knowledge needed for a circularity transition	RCS
	Establishing or supporting CE research, innovation and knowledge development through collaboration platforms, knowledge hubs, research projects ('urban living labs', 'fab labs', 'Smart citizen labs' etc.).	RCS
Social justice and livelihoods	Fostering inclusivity and social justice by guaranteeing equal access to urban infrastructure and services (e.g., welcoming refugees, building accessible infrastructure, and securing access to quality education, healthcare, recreational facilities, cultural and artistic activities etc.).	TCS
	Promoting and building community housing , social housing, housing cooperatives and community land trusts .	TCS
	Encouraging and supporting the creation of local currencies and cooperative banking to support CE-related activities.	TCS
	Promoting sharing economy activities (repair cafés, fab labs, swap shops, second-hand shops, zero-waste café etc.) by providing resources, infrastructure, and digital platforms.	RCS

5. Case study analysis

5.1. Amsterdam

5.1.1. Background and context

Amsterdam is the capital of the Netherlands and the country's largest and most populated city, with a population of approximately 863,000 (Municipality of Amsterdam, 2021 a). The city is a central location within the Netherlands for the industry and service sectors, in particular, business and finance, and is home to the 4th largest port in Europe (Fratini et al., 20190). Its citizens are also slightly wealthier than the national average, with a median gross income of €38,300 (£33,000) (Municipality of Amsterdam, 2021 b).

The Netherlands is a decentralised unitary state and is democratically institutionalised at the national, provincial, and municipal levels (Heurkens & Dąbrowski, 2020; European Committee of the Regions, 2020a.). At the municipal level, authorities have power over a variety of policy areas related to the CE such as spatial planning and urban development, waste and recycling, and transport and local infrastructure. Municipalities have a general competence called 'open household' that is constitutionally protected. This means that within their borders, the Municipality of Amsterdam can levy taxes and develop their own by-laws and policies in any policy area as long as it does not conflict or violate national policy or constitutional bounds (European Committee of the Regions, 2020a.). However, municipalities in the Netherlands are largely reliant on grants from the national government, with only some funding from tax revenues, and tariffs and fees ((OECD/UCLG World Observatory on Subnational Government Finance and Investment, 2019a). Thus, at the municipal level, informal municipal-metropolitan-regional governance networks are often present and public-private partnerships are especially prevalent, influencing formal policy creation, implementation and governance more broadly (Heurkens & Dąbrowski, 2020).

Circular Economy in the Netherlands

The notion of the CE is prominent within governmental debates in the Netherlands and is mostly concerned with how the CE can address waste and resource dependency within the context of the country's climate ambitions (Savini, 2019). Since 2014, the Dutch government has produced programmes and strategic documents aimed at implementing various CE projects, initiatives, interventions and pilots over the next 30 years. Within their Waste to Resource programme (Ministry of Infrastructure & Environment, 2014) the government first experimented with new production and consumption processes through various interventions and pilot projects, highlighting the importance of resource efficiency in key industries such as logistics, agribusiness, technology, and the construction and creative sector. The projects aimed to redefine waste regulation, so that rather than attempting to mitigate the environmental stress of waste, waste could be seen as a resource (Savini, 2019). The projects also aimed to develop national-local partnerships; foster specialised research and development programmes for efficient product development in the building, food and high-tech sectors; and develop changes in consumer culture through promoting sharing and reuse projects within local neighbourhoods (Savini, 2019).

In 2016, the projects and initiatives of the Waste to Resource programme fed into the Dutch Governments' 'The Netherlands Circular in 2050' programme (Ministry of Infrastructure & Environment, 2016) which organises multi-level governance initiatives in five key sectors: remanufacturing, consumption, construction and biomass/food. These initiatives include, for example, establishing data exchange platforms for material recovery and reuse in relation to eco-design and product development, changing packaging and extended producer responsibility regulation, providing educational programmes in school on waste, and developing a circular seaport programme to help connect the port of Amsterdam and Rotterdam to share material waste streams (Ministry of Infrastructure & Environment, 2016; Savini, 2019).

At the urban level, the Dutch government through the CE programme has been developing multi-level cross-sectoral governance strategies geared towards experimentation and innovation in CE policy areas such as waste reuse, the bioeconomy and the integration of material streams (Fratini et al., 2019; Savini, 2019). The government has signed around 18 city-deals and 200 'green deals': contracts for experimenting with innovative solutions to promote green economic growth and the CE (Savini, 2019). The city-deals aim to

encourage access to new markets for demand and supply side CE stakeholders by sharing knowledge and best practices through joint online platforms (*City Deal Circular City*, n.d.) and the Green Deals programme aim to address non-financial barriers for CE initiatives to create a protective space for economic activities and to help stabilise and scale up CE innovations once they have shown initial success (Fratini et al., 2019). Thus, overall, action at the city level on the behalf of the Dutch Government is predominantly focussed on generating economic growth, stimulating innovation and facilitating the creation of circular business models and the CE is generally valued for the role that it can play in managing waste and improving resource efficiency. Since there is also little to no discussion about socio-environmental challenges or concerns, Dutch CE policy then aligns with the TCE discourse.

5.1.2. Circular Economy Journey in Amsterdam

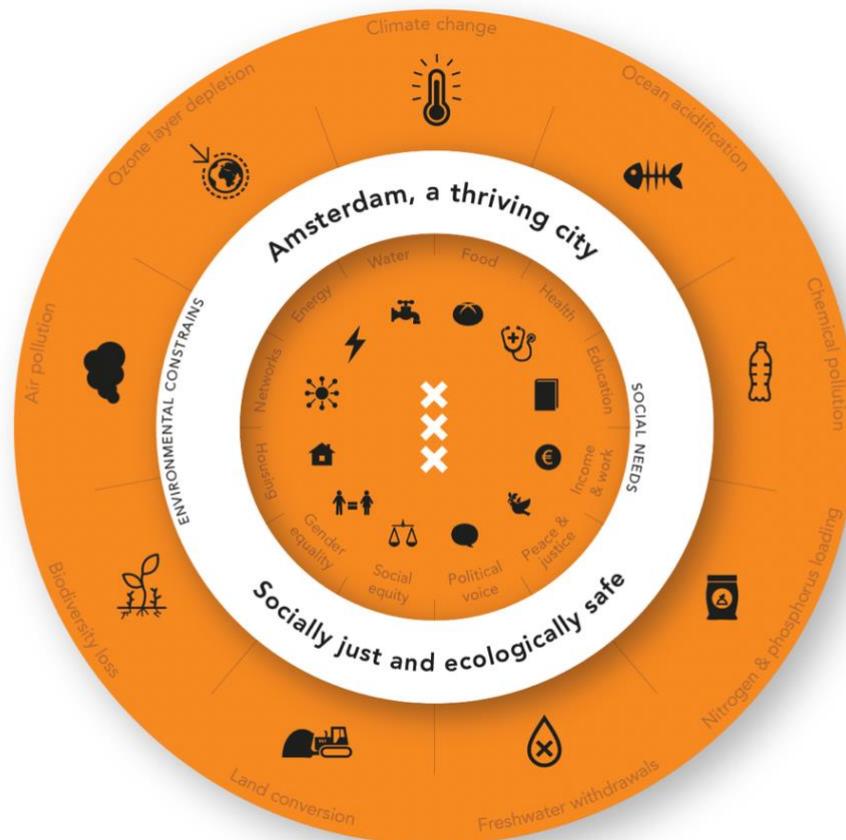
Amsterdam is often coined as the leader in the ‘circular city’ movement and is used as an example of best practice in the urban CE transition (Heurkens & Dąbrowski, 2020; Obersteg et al., 2019). The origins of the CE policy discourse in Amsterdam can be traced back to early debates concerning the efficiency of the water and waste utility sector in the city in 2009. At that time, the green-left government created implementation plans with the aim of combining sustainable urbanism and economic development, viewing the stimulation of a resource economy and the development and extension of a residual heating network as a way of boosting the urban economy during the global financial crisis. (Cuomo et al., 2020). The CE, in particular, was first acknowledged and used in the redevelopment of the Buiksloterham area, a residential and industrial district close to Amsterdam’s Central Station. As an ‘urban living lab’, Buiksloterham became a key reference project for future CE initiatives in the city due to the unique combination of remanufacturing and design alongside residential redevelopment (Savini, 2019; Savini & Dembski, 2016). The concept was formally adopted within the Municipality of Amsterdam’s sustainability agenda in 2015, with a specific CE action agenda created the following year. This CE agenda sought to foster collaboration between various different actors (citizens, local businesses, consultancies, NGOs etc.) within the city, prioritising two material waste streams: construction and organic materials (Campbell-Johnston et al., 2019; Savini, 2019).

Today, Amsterdam’s CE landscape is a diverse network of interventions, policies and projects. In 2020, the green-left municipal government published the Amsterdam Circular Strategy 2020-2025 (Municipality of Amsterdam, 2020a); the result of five years experimentation in the city across various domains, such as the reuse of organic waste in energy production, and the decentralisation and integration of waste and water infrastructure, for example (Cuomo et al., 2020). The main aim of the CE strategy is to make Amsterdam a ‘thriving and equitable city’. Specifically, the municipality notes:

“In this city we want to ensure a good life for everyone within the Earth’s natural boundaries. We want to be a city in which prosperity and wellbeing for everyone come first.”

(Municipality of Amsterdam, 2020a, p.5)

A good life, according to the CE strategy, is defined not only in terms of material wealth but also includes wellbeing, good health, pleasant living environment and space for personal growth. These societal and environmental ambitions are included in the CE through the city’s embracing of the Doughnut Economic model (Figure 5.1) developed by Kate Raworth. 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 (Municipality of Amsterdam, 2020a). 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 on a society can thrive in a sustainable, safe and equitable way (Municipality of Amsterdam, 2020a).



Kate Raworth's doughnut model.

Figure 5.1: Amsterdam City Doughnut (Municipality of Amsterdam, 2020a)

The municipality’s overarching goals and targets, however, are for Amsterdam to become fully circular by 2050, to reduce CO2 emissions by 55% compared to 1990, halve the use of new raw materials by 2030, ensure 100% circular procurement and a 20% reduction in public consumption by 2030 (Municipality of Amsterdam, 2020a). Material and energy efficiency here are thus measured with clear targets and objectives for the future and they also have a more robust monitoring system in place (Municipality of Amsterdam, 2020b). However, with societal concerns, there are only broad overarching visions for the future of Amsterdam as a progressive and prosperous city, with no tangible goals or targets as, according to the municipality, they are still in the process of developing a system for modelling prosperity (Municipality of Amsterdam, 2020b).

5.1.3. Conceptualisation of the Circular Economy

The CE in Amsterdam is defined predominantly as a method of waste prevention, promoting resource efficiency and economic savings. In a CE, according to the strategy, waste is prevented and reduced by:

“... preserving the value of products, components and raw materials in closed cycles for as long as possible, which leads to us being left with less waste. This way we can reduce the burden on the environment and save costs without sacrificing quality.”

(Municipality of Amsterdam, 2020a, p.10)

However, defining the CE in the context of the city doughnut model, the CE is also about fostering healthy dynamics between social and ecological issues, thus, Amsterdam takes a more holistic definition of the CE which is in line with the RCS discourse.

The CE strategy also outlines Amsterdam’s own CE value retention hierarchy (Figure 5.2), differing from the hierarchy developed by Reike et al. (2018) in that there is a focus additionally on ‘rethinking’ and no focus on remining (R9). How the strategy has operationalised the CE through the hierarchy indicates an

awareness of all the 10R's on the value retention hierarchy, intersecting, to some extent, with all the four discourse types. However, the hierarchy does not include social R's such as redistribute, re-evaluate, re-conceptualise and re-localise, for example, so is more aligned to the segmented more than the holistic discourse types.

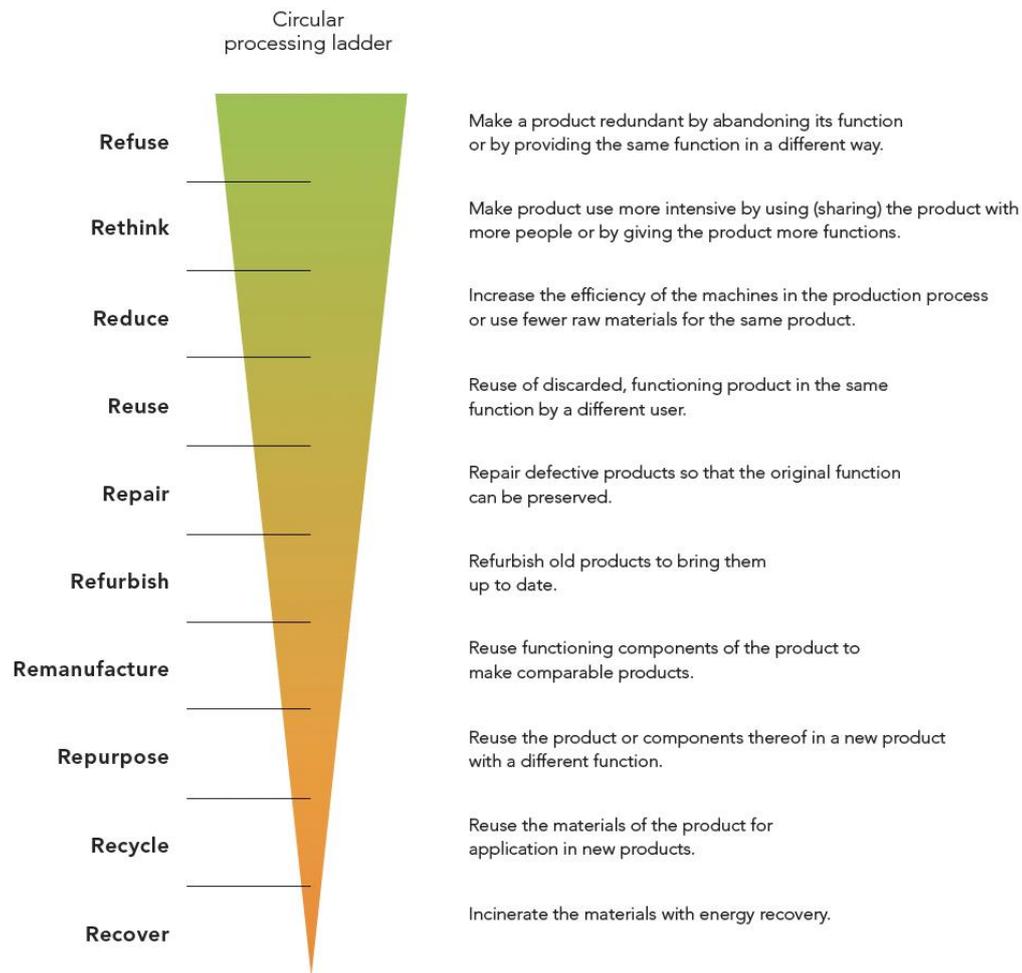


Figure 5.2: Amsterdam's CE value retention hierarchy (Municipality of Amsterdam, 2020a)

5.1.4. Problematisation

The transition towards a CE is framed within the context of the ecological crisis and need for social justice. However, the CE strategy's concerns are anthropocentric in their nature, focussing on the negative impact of the ecological crisis on current and future generations and those living in the global south. Indeed, the municipality note how society is using raw materials as if they are in unlimited supply, using than the earth can provide. As such, global temperatures are increasing, nature reserves are under pressure and biodiversity is declining at a worrying rate (Municipality of Amsterdam, 2020a). This is of concern for young people and future generation who will have to endure the negative impacts of the ecological crisis for years to come. Furthermore, the municipality notes how:

“consumption here influences prosperity elsewhere, for example, through working conditions during the extraction of raw materials and the manufacture of products.”

(Municipality of Amsterdam, 2020a, p.10)

Thus, the municipality are also concerned with individuals in the global south who already suffering and are disadvantaged (Municipality of Amsterdam, 2020a).

Of specific concern is the current systems and habits of production and consumption and their immense impact on the supply of raw materials, the climate and the living environment more generally. The Municipality have highlighted particular sectors and waste streams which are particularly problematic in Amsterdam, which include the construction of new homes, office buildings and public infrastructure, and the consumption of meat and dairy products (Municipality of Amsterdam, 2020b). The consumption of consumer goods such as clothing and electric appliances are also significant, however, according to the municipality, consumer goods have less of an environmental impact (Municipality of Amsterdam, 2020b).

Nevertheless, the municipality of Amsterdam do not highlight a specific group of actors, economic systems, institution or set of policies, for example, (other than discussing the impact of the global north on the global south) which may be responsible for the ecological crisis or unsustainable production and consumption habits more specifically.

Responsibilities

The Municipality of Amsterdam dictates that their primary role in the CE transition is to inspire, motivate and direct. However, when it comes to modifications in public spaces and the maintenance of roads, bridges or municipal buildings, for example, they must take responsibility. The municipality also notes that it is their responsibility to incentivise local and regional businesses to become circular through their procurement processes and where they have no mandate for change, they must seek cooperation with other authorities and stakeholders in order to achieve their ambitions (Municipality of Amsterdam, 2020a).

The municipality takes a sector-based approach, cooperating with 'promising target groups' i.e., port and industry and social institutions (Municipality of Amsterdam, 2020a, p.28). The Port of Amsterdam and industry play a significant role in the CE transition as there is the potential, according to the municipality, to turn the port into a 'circular ecosystem' where industries utilise each other's waste streams (Municipality of Amsterdam, 2020a, p.29). Indeed, by targeting port and industry, according to the municipality, it is possible to apply a chain-oriented approach on an industrial scale as it focuses on both the production and processing.

Social institutions such as museums, universities, schools and hospitals, and the corporate market are of importance due to the role they play in the citizens lives and the direct impact they have on primary raw material use (Municipality of Amsterdam, 2020a). In particular, there is a significant level of responsibility placed on medium and large sized businesses to transition to circularity. This is where the municipality expects the largest impact to come due to the large amounts of industrial waste produced and the opportunities afforded by circular enterprise (Municipality of Amsterdam, 2020a). Indeed, according to the municipality, businesses and the corporate market are key to creating coalitions and developing solutions for reducing waste, are responsible for eco-design and, in the future, with extended producer responsibility schemes, they can take control and responsibility for the end of life of their products, thus are crucial to a successful CE transition (Municipality of Amsterdam, 2020a).

Lastly, the Municipality of Amsterdam note the key role that citizens play in the transition to CE through changes in habit (in particular transitioning to healthier and more sustainable diets and reducing the consumption of new and unnecessary products) and how they deal with their waste more broadly (i.e., how the separate and throw away their waste) (Municipality of Amsterdam, 2020a, 2020c). The municipality can facilitate, to a certain extent, behavioural change through awareness raising and education, and making sharing economy activities more attractive and accessible (Municipality of Amsterdam, 2020a), for example.

5.1.5. Benefits and opportunities

The Municipality of Amsterdam note four main benefits and opportunities created in the transition to a CE (Municipality of Amsterdam, 2020a). First, they highlight to the ability to create a fairer society: through purchasing services rather than owning products, the municipality argues that valuable products can be accessible for all now and in the future. Second, the transition to CE can create a more resilient society: by becoming less reliant on the imports of raw materials and products, Amsterdam can become more self-sufficient and self-reliant. Third, they highlight the ability to create a healthier world through reducing the emissions and use of toxic substances which damage the health of humans and the planet. Lastly, the transition to a CE can create a more efficient economy: by reclaiming raw materials and products locally, new activities will be created with less waste and jobs in various sectors will be created. The municipality also note,

however, various economic opportunities for that will be created for ‘frontrunners’ through increased innovation, the transition to circular business models, and greening pension portfolios (Municipality of Amsterdam, 2020a). Specifically, they note the competitive advantage businesses and frontrunners can gain through circular innovation or entering into new collaborations and partnerships and exchanging knowledge and materials with each other (Municipality of Amsterdam, 2020a). Thus, the main beneficiaries of the transition towards a CE in Amsterdam appear to be businesses but also citizens through the CE’s ability to create a fairer and healthier world, aligning with RCS discourses.

5.1.6. Circular Economy policies

Within the CE strategy, the municipality identified three main policy areas of concern: Food and organic waste streams, the built environment and consumer goods. However, according to the framework, the strongest action is taken in the policy areas of governance and municipal operations (72%), education, and knowledge development (65%) and, food and organic waste streams (70%) (Figure 5.3). On the other end of the spectrum, there is a lack of consideration of improving ecosystems and using nature-based solutions (6.7%), such as green infrastructure and improving green spaces despite its utility in transitioning to the CE. Furthermore, there is little consideration of policies pertaining to the built environment and spatial planning, with a lack of focus on urban form and territorial planning (10%) and, transport and mobility (15%). It is worth noting, however, that the CE in Amsterdam is still in its infancy and is thus at an exploratory phase, with many research activities, pilot projects, and collaborative experiments taking place alongside businesses, universities and other key actors. Indeed, Amsterdam describes itself as a “progressive and liberal city that is not afraid to experiment or to invest in the future” (Municipality of Amsterdam, 2020a p.20) In the future, these projects may lead to strong action or be upscaled and become the mainstream.

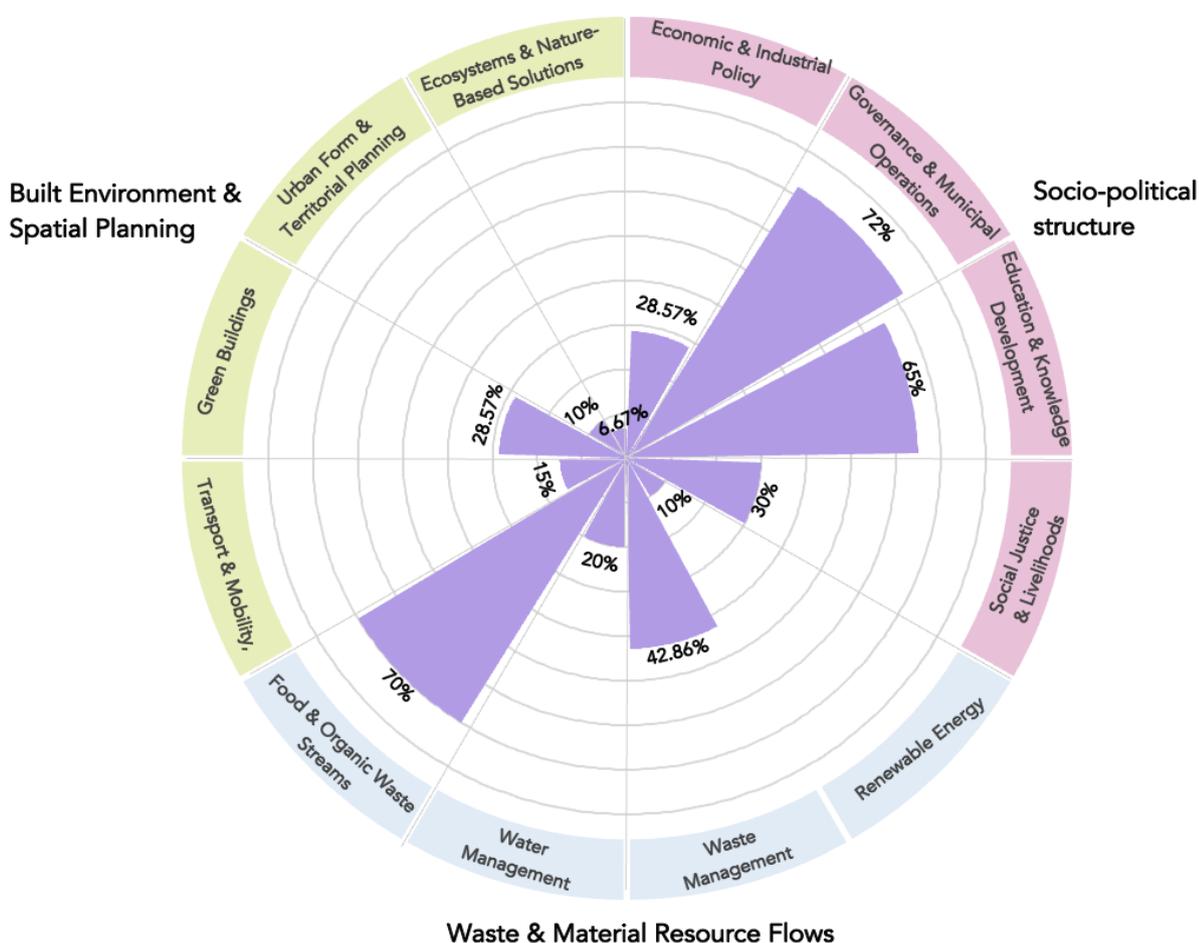


Figure 5.3: Policy areas addressed in Amsterdam’s CE strategy

Waste and material resource flows

Overall, there is a specific emphasis on facilitating innovation, particularly through research, pilot projects and support for CE initiatives and start-ups to improve the circularity of resource and waste streams. Within this policy category, as mentioned, Amsterdam takes the strongest action in the policy area of **food and organic waste streams**. The municipality acts to promote urban agriculture and the consumption of locally grown food through supporting CE initiatives and working with external stakeholders to create, for example, circular regional food hubs which will efficiently transport and distribute local produce (Municipality of Amsterdam, 2020c) and is working to encourage household composting and bio-digestion through providing residents with garden compost bins or locations to compost locally. Furthermore, the city is also working to establish centralised bio-waste management systems through the deployment of collection containers and supporting pilot and research projects, experimenting with food waste prevention methods via pilot and research projects and is encouraging shifts towards plant-based diets through the Amsterdam Healthy Weight Programme (Municipality of Amsterdam, 2020c).

The Municipality of Amsterdam is also committed to tackling **waste management**, for example through improving access to infrastructure through installing more underground containers (Municipality of Amsterdam, 2020c), using pilot projects to explore alternatives to single-use packaging, and fostering the creation of secondary materials markets, particularly in the context of the built environment and consumer goods. Furthermore, the municipality is also, to some extent, committed to supporting and fostering urban industrial symbiosis through research programmes and experiments, and the creation of circular material depots (Municipality of Amsterdam, 2020c).

Little action is taken concerning **water management** and **renewable energy**. Only through research projects on the recovery and recycling of wastewater and the efficiency of water provision in swimming pools is water management being progressed (Municipality of Amsterdam, 2020c). With the shift to renewable energy, the municipality is only involved in supporting and participating in a research projects concerning a green hydrogen plant (Municipality of Amsterdam, 2020c). Thus, in the future, most progress can be made in these two policy areas.

Built environment and spatial planning

In Amsterdam, there is a general lack of focus on the built environment and spatial planning category. For example, **ecosystems and nature-based solutions** are only included in the CE strategy through an experimental food forest project in south-east Amsterdam and, in terms of **urban form and territorial planning** policies, the municipality is only focussed on fostering urban-rural symbiosis through their participation in the EU RUMORE project (Municipality of Amsterdam, 2020c). Furthermore, in the area of **transport and mobility**, the municipality only briefly mentions the action of renting and sharing cars and is supporting the circular construction of the extension to the north-south railway line (Municipality of Amsterdam, 2020c). The most significant action in this category is taken in the **green buildings** policy area, however, commitment to this policy area is surprisingly low despite the municipality prioritising the built environment within the CE strategy. Generally, the municipality is working to tighten the environmental performance standards of buildings by exploring at what would be technically feasible and is working with developers and other municipal partners to create a circular area development plan which will set minimum requirements for building more broadly in the city (Municipality of Amsterdam, 2020c). Furthermore, through small pilot and research projects, the city is investigating the circular recovery of demolition waste (Municipality of Amsterdam, 2020c) and how to repurpose and renovate old and disused buildings and infrastructure to increase material and energy efficiency (Municipality of Amsterdam, 2020c).

Socio-political structure

The municipality is most committed to policies in the socio-political structure category, in particular, **governance and municipal operations**. The municipality is establishing and participating in over 20 public-private partnership style arrangements, according to the CE implementation plan, and has a significant focus on circular public procurement and public infrastructure, and circular tender as a way of encouraging businesses to adopt more circular business models (Municipality of Amsterdam, 2020c). In terms of **education**

and knowledge development policies, the municipality is engaging in various communication initiatives to raise awareness of circularity and change behaviours, particularly concerning changes in diets and encouraging the sharing and repairing of goods. Furthermore, the municipality is supporting projects to reskill and educate citizens, job seekers and municipal employees on the CE and are working with universities and research facilities to carry out urban living labs and research projects in various sectors such as food waste, the built environment, and data and logistics (Municipality of Amsterdam, 2020c).

Concerning **economic and industrial** policies, the municipality primarily engages with and supports CE initiatives and start-ups and works with a plethora of research programmes to test the effectiveness and utility of high-tech innovations in the CE transition (Municipality of Amsterdam, 2020c). However, to a certain extent, the municipality also supports deregulation and liberalisation to support innovation and foreign investment in new CE initiatives and businesses through lobbying for change at the national or EU level, for example, and promote the local production and consumption of goods through initiatives such as Amsterdam Made, a community of 150 manufacturing companies in the metropolitan area who strive to be more circular and sustainable (Municipality of Amsterdam, 2020c). Lastly, in terms of **social justice and livelihoods** policies, the municipality is predominantly focused on fostering and promoting sharing economy activities through, for example, establishing a circular second-hand depot and training facility to make sharing more accessible and attractive amongst citizens (Municipality of Amsterdam, 2020c). Beyond the sharing economy, however, there is no substantial commitment to fostering inclusive and social justice through improving access to public amenities for its citizens, for example, and only a small research project is being carried out to look at what community land-trusts would mean for commissioning and alternative business cases (Municipality of Amsterdam, 2020c).

Policy-discourse type

Overall, based upon the policies and actions proposed within the CE strategy, Amsterdam is aligned to both the RCS (41.3%) and TCE (45.8%) discourses (Figure 5.4), indicating a strong level of optimism about the role of technological innovation in preventing economic collapse and a level of ambivalence about the need to integrate the socio-political concerns into the CE. However, in words, Amsterdam positions itself as much more socially progressive, with actions framed within the context of the doughnut model.

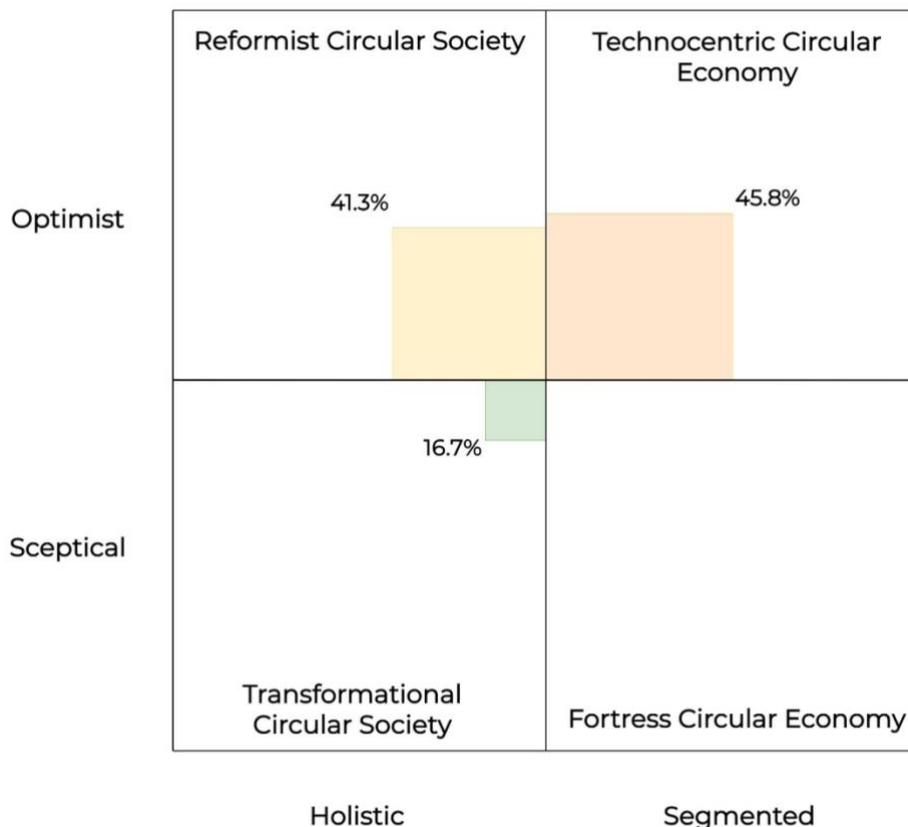


Figure 5.4: Strength of the relationship to the four CE discourse types in Amsterdam

5.1.7. Governance of the Circular Economy

Participation and deliberation

The creation of the Municipality of Amsterdam's CE strategy was partly a participatory and deliberative process. In the beginning stages when the municipality was exploring how the doughnut model could be used in the city, they arranged open and voluntary participation meetings in the seven districts of Amsterdam to engage and ensure broad and continued dialogue with a broad and diverse range of citizens (Municipality of Amsterdam, 2020a, 2020d). These meetings asked participants to think about:

“how can Amsterdam be a home to thriving people, in a thriving place, while respecting the wellbeing of all people, and the health of the whole planet?”

(Municipality of Amsterdam, 2020d, p.3)

Their answers helped to form the basis of the creation of 'The Amsterdam City Doughnut'. The city doughnut, to some extent, fed into the Amsterdam 2020-2025 CE strategy, allowing a level of input from citizens concerning what a circular future, according to the doughnut model, may look like (Municipality of Amsterdam, 2020a). However, the extent to which the views and opinions of the residents are included in the CE strategy and the amount of influence they had on is unknown and, as the participatory meetings were broadly open to the public, it is unknown whether the group of citizens involved were as broad and diverse as the municipality intended. The Municipality of Amsterdam also worked closely with key stakeholders such as experts, local businesses, NGOs, societal organisations, to get advice and suggestions on how the CE can be advanced in the city and to ensure support from outside the municipality itself (Municipality of Amsterdam, 2020a). However, the final decisions concerning the CE strategy were made by individuals and senior civil servants within the municipality, thus, you can assume that the policies proposed and how CE has been conceptualised and problematised is reflective mostly of the views and discourses of the Municipality of Amsterdam.

Modes of governance

Overall, the Municipality of Amsterdam utilises both top-down and bottom-up approaches to the CE transition, focussing mostly on governing through self-governance and enabling, with some focus on provisioning (Table 5.1). Similar to Glasgow, there is a particular emphasis on enabling through partnerships with key stakeholders in the private sector. For instance, the municipality work(ed) closely with the Thriving Cities Initiative (TCI) a collaboration between C40, Circle Economy, Doughnut Economics Action Lab in order to develop the City Doughnut and share knowledge and example of best practices in circular cities (Municipality of Amsterdam, 2020d). Furthermore, the Municipality works closely with circular businesses and organisations through pilot projects and research programmes to test circular innovations and engages in awareness raising activities to encourage changes in consumption patterns (Municipality of Amsterdam, 2020c). In terms of self-governance, the Municipality of Amsterdam focuses on circular public procurement and tender principles and standards as a fairly easy way of implementing CE in Amsterdam. Furthermore, the municipality is working to make its transport fleet, for instance, more sustainable and is dedicated to making public spaces and its own buildings more circular through testing new circular building techniques (Municipality of Amsterdam, 2020c). Through governing by provision, Municipality of Amsterdam are, for instance, promoting better waste management through providing more underground waste containers and providing all citizens access to or their own compost bins, and are providing direct support and resources for CE start-ups and initiatives (Municipality of Amsterdam, 2020c).

Table 5.1: Modes of governance used in Amsterdam with examples of policies

Mode of governance	Example of policies (Municipality of Amsterdam, 2020c)
Self-governance	<ul style="list-style-type: none"> - Circular public procurement and tender principles and standards - Making transport fleet more sustainable - Improving the circularity of public spaces and its own buildings
Enabling	<ul style="list-style-type: none"> - Promote the local production and consumption of goods through initiatives through Amsterdam Made - Public-Private partnerships with key stakeholders in the private sector - Creation of knowledge hubs for reducing food waste and developing circular building criteria
Provision	<ul style="list-style-type: none"> - Providing more underground containers for waste disposal - Providing all citizen access to or their own compost bins - Providing support and resources for CE start-ups and initiatives.
Authority	

5.2. Glasgow

5.2.1. Background and context

Glasgow is Scotland's largest and most populated city, with a population of approximately 633,000 in the immediate area and 1.2 million in the greater Glasgow area (About Glasgow City Council | The Glasgow Indicators Project, n.d.) Glasgow is known for being a 'vibrant, cosmopolitan and award-winning city' with a rich industrial past and is a significant area in Scotland for business and economic activity (About Glasgow City Council | The Glasgow Indicators Project, n.d.). Indeed, Glasgow has a diverse economy, with strengths in various sectors relevant to the CE such as retail, financial services, engineering and manufacturing, and digital technology (Invest Glasgow, n. d). However, Glasgow is also one of the most deprived areas in Scotland. The median gross salary in Glasgow is £23,040 (€26,886) which is less than the national average (26,400) and according to the 2020 Scottish Index of Multiple Deprivation, Glasgow has areas ranked first in Scotland for lowest income, most deprived housing stock and poorest health, with around a third of children in the city lived in poverty in 2017 (Glasgow City Council 2020a, p.67, 69).

The United Kingdom (UK) is an asymmetrical decentralised unitary state comprised of England and three devolved nations: Scotland, Wales and Northern Ireland. Whilst the UK have absolute sovereignty, the Scottish Government has varying degrees of legislative powers, including the power to set income tax rates, aggregate levy, and control education, transport, environmental policy, for example (European Committee of the Regions, 2020b). The UK is also democratically institutionalised at the local council level, with a number of powers and duties set out in legislation. Scottish local councils have regulatory competencies and/or provide services in CE related areas such as waste management, transport and roads, local public housing, environmental protection, community planning and empowerment, and economic development and regeneration, for example (European Committee of the Regions, 2020b). Local councils are reliant predominantly on funding from the Scottish Government, however, they are also able to generate some revenue through council tax which it sets itself (OECD/UCLG World Observatory on Subnational Government Finance and Investment, 2019b)). Nevertheless, since the financial crisis in 2008 and the subsequent implementation of austerity measures by the national government, councils across the UK have had their funds cut significantly (Lowndes & Pratchett, 2012). This has limited their resources and capacity to stimulate the sustainability transition at the local level (Turcu & Gillie, 2020).

Circular Economy in Glasgow

CE and waste policy, more broadly, is a complex landscape, with UK, European and global dimensions to take into consideration. The Scottish Government works with the European Commission, UK government and the other devolved nations on policy and regulation to give new impetus to CE businesses and more efficient and effective resource management systems (Scottish Government, 2019). However, each devolved nation and England is responsible for setting their own CE and waste policies.

CE policy in Scotland first was set out in 'Making Things Last' strategy in 2016 and aims to develop a comprehensive approach to extended producer responsibility and, address and expose the costs of recycling and disposal (*Scotland: Making Things Last - A Circular Economy Strategy*, 2016). Based on environmental impact, resource use and importance to the Scottish Economy, four priority areas are explored: food, drink and the bio economy; remanufacturing; construction and the built environment; and energy infrastructure (Scottish Government, 2016). To further their CE ambitions, the Scottish parliament is expected to pass a new CE bill in 2021 which will include measures such as the implementation of a deposit return scheme, single-use disposable cup charges and an extended producer responsibility scheme for packaging in partnership with the UK government. Furthermore, the Scottish government is working to transpose the EU Circular Economy Package, including the Single-use Plastics Directive (SUP), into Scottish Law (Scottish Government, 2019). The Scottish Government does not work directly to stimulate the CE transition at the city level. However, the Scottish Government, alongside the European Regional Development Fund, finance Zero Waste Scotland (ZWS), a not-for-profit environmental organisation which aims to inform policy, and motivate and facilitate individuals and business to embrace the economic, environmental and social benefits of a CE (Who We Are, n.d.). ZWS interacts with the CE at the city level through its Circular Cities and Regions Programme; engaging in partnerships with organisations across Scotland's urban areas, helping to exploit key businesses and sectors for circular growth.

Overall, the CE strategy in Scotland is heavily focussed on the management of material and resource flows, aligning with the TCE discourse

5.2.2. Circular Economy journey in Glasgow

The transition towards a CE first began in 2015, when Glasgow Chamber of Commerce (GCC), ZWS and Glasgow City Council came together to explore what role Glasgow could play in the transition to a CE. Consequently, 'Circular Glasgow' was established, ran mostly as an initiative of GCC, to "*inspire businesses to adopt innovation, design thinking and circular economy business models.*" (*How We Got Here – Circular Glasgow*, n.d.). The primary function of Circular Glasgow is to help Glasgow businesses measure their current levels of circularity, inspire them to adopt circular business practices and then subsequently, help the businesses to implement those practices (Inspiring a Circular Glasgow, n.d.). In doing so, Circular Glasgow hope that businesses can help contribute to improving Glasgow's sustainability and net zero ambitions whilst also improving profit and stimulating growth.

During its conception, Circular Glasgow together with Dutch consultancy company, Circle Economy, carried out a Circle City Scan to identify key sectors and areas of opportunity to pilot CE thinking in Glasgow, namely healthcare, education, and manufacturing. Manufacturing was selected as the key focus due to the city's heritage and particular focus was given to the food and beverage industry, and the construction, events, tourism, finance, and the creative sectors (Inspiring a Circular Glasgow, n.d.). These key sectors identified by Circular Glasgow and Circle Economy are now addressed in the CE route map.

This business led approach taken by Circular Glasgow 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 route map outlines a 10-year vision which aims to guide the city away from the 'take-make-dispose' model of the current linear system to a circular system of 'quality, reuse and durability'. In particular, it is intended that the route map will enhance awareness of different sustainable practices, promote a message of more thoughtful consumption, and challenge the wasteful consumerist practices that exist in Glasgow and more broadly in society (Glasgow City Council, 2020b). Within this vision, Glasgow City wants to create a future where they:

“...maximise the value in all of our materials and minimise our consumption. It is within a Circular Economy that the city will rebuild itself stronger, will be more connected, and more successful, ensuring a secure future for all Glaswegians.”

(Glasgow City Council, 2020a, p.2)

5.2.3. Conceptualisation of the Circular Economy

Glasgow City Council define 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). Furthermore, Glasgow City Council also follows the EMF's understanding of CE (which echo's C2C rhetoric), noting that the transition towards a CE should take a systemic approach to economic development, benefitting the environment, society and businesses and aim to gradually decouple economic growth from resource consumption (Ellen MacArthur Foundation, n.d, cited in Glasgow City Council, 2020a).

Glasgow City Council further define their own guiding principles of the CE and the material flow building blocks for the city. The nine guiding principles include recognising residual value, supporting the sharing economy, community sharing, reducing consumption and promoting reuse, behaviour change, developing the 'second hand' market, encouraging eco-design, and ending planned product obsolescence (Glasgow City Council, 2020a). The key material flow building blocks for the city are repair and maintain, remanufacture, and recover and recycle. As such, Glasgow City Council focuses on the immediate loops of the CE value retention hierarchy, in particular, reuse (R2), repair (R3), refurbish (R4), remanufacture (R5), repurpose (R6), and recycle (R7). Glasgow City Council's understanding of the CE is, thus, in line with the RCS discourse type.

5.2.4. Problematisation

In Glasgow, the transition to a CE is situated within the context of various overlapping and complex problems. The city council provides an extensive critique of neoliberalism and globalisation as the overarching problems that have created various key challenges such as inequality and poverty, the climate emergency and the dramatic effects of the COVID-19 pandemic (Glasgow City Council, 2020a). Glasgow City Council note how

“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”

(Glasgow City Council, 2020a, p.16)

has presented a disastrous set of outcomes, namely, the prevalence of low paid insecure jobs, social exclusion, and structural poverty. According to the council, such deprivation and social exclusion is a significant problem for representative democracies and hampers civic participation levels as if citizens feel like they are adequately involved in decision making processes, they can recognise the reasons for change and thus regard it as something they can influence. However, if citizens feel alienated from the political processes, they will disassociate themselves and will be reluctant to participate, thus, making change at the city level challenging (Glasgow City Council, 2020a). Thus, it is within the interest of the city council to not only tackle deprivation and social exclusions as problems in and of themselves but, also to address these concerns to make the transition process to a CE in Glasgow easier.

According to Glasgow City Council, the neoliberal globalised system has required industries to create demand for products and manipulate consumers' desires through programmes of planned obsolescence, creating a culture where the vast majority of the population own items that they do not need or should not have been produced in the first place (Glasgow City Council, 2020a). These unsustainable production and consumption practices must be tackled, according to the council, as:

“we cannot continue to plunder scarce natural resources to satisfy our current demands as a consumerist economy.”

(Glasgow City Council, 2020a, p.37).

To change these practices, according to the council, there must be a paradigm shift in consumer culture, and a huge commitment to changing working practices and business models, and this can be achieved in the transition to a CE. Glasgow City Council also notes how the transition to a CE in Glasgow must build on the momentum created by their declaration of a climate and ecological emergency and the upcoming United Nations Climate Change Conference (COP26). According to the council,

“the Climate and Ecological Emergency demands urgent action. We need to act now.”

(Glasgow City Council, 2020a, p.5).

Under globalised neoliberalism, society has, and continues to have, a damaging and lasting impact on the environment and planetary resources, and scientific evidence strongly indicates that the continuous rise in global temperature is linked to carbon intensive human activity (Glasgow City Council, 2020a). Thus, the council emphasises that everyone in Glasgow must play their part and act or implement measures to avoid the most serious ill-effects of climate change and environmental catastrophe (Glasgow City Council, 2020b).

Lastly, the COVID-19 pandemic has, according to the council, highlighted the fragility of hyper-globalisation and its complex international supply chains, and the need to return to more localised and equitable economic systems, which could be achieved through the CE. Moreover, as the pandemic has disrupted social norms, this is the perfect opportunity to instil change and transition to a more sustainable and equitable system.

Responsibilities

Glasgow City Council also places strong emphasis on the role of businesses in the CE transition, noting that cities are the ideal location for new circular business models to be developed due the resource density in compact geographic areas (Glasgow City Council, 2020a). Indeed,

“The business community have a key role to play in creating this systemic change, supporting the need to move away from a ‘business as usual’ model, to one that encourages and supports innovative approaches to sustainability “

(Glasgow City Council, 2020a, p.7)

The city council notes the role that they play, however, in aiding the transition to circular business models. In particular, the city council emphasises that, as a local authority, they have very little technical control over eco-design methods in the city economy, thus, their role is to open up opportunities for innovation and educators (Glasgow City Council, 2020a). Furthermore, Glasgow City Council state that if they demand that small innovative and community businesses adhere to circularity and sustainability standards and principles, they must ensure that financial and property arrangements are put in order to ensure their survival and future growth (Glasgow City Council, 2020a). The city council also note that they should support legislation and regulation imposed at the national and transnational level which would then influence action within their jurisdiction, particularly pertaining to businesses.

5.2.5. Benefits and opportunities

The potential benefits and opportunities noted in the CE route map are predominantly anthropocentric, focussing on the economic and social benefits that the CE can bring more than the benefits the CE can create for the environment. Specifically, the benefits and opportunities can be divided into two key themes: (1) Through localising the economy in the CE transition, a system can be created based upon social inclusion, justice and wellbeing and opens up opportunities for job and wealth creation (2). The CE transition can create new opportunities for local businesses and foster innovation (Glasgow City Council, 2020a). The CE transition is identified as a keyway of rejuvenating the manufacturing sector, for example, in Glasgow after deindustrialisation in the late 1960s. Becoming a ‘thriving centre for remanufacturing’, the city council notes, will support job creation, and provide economic opportunities for deprived and unemployed communities in Glasgow (Glasgow City Council, 2020a). The CE route map also argues that the CE can help to re-energise

local communities to build resilience and enhance self-sufficiency. Localising the economy through the CE transition, according to the council, can help retain wealth within communities, produce high-quality and well-paid jobs and encourage public/private business creations. Thus, according to the council, social issues are mostly addressed through promoting fair and inclusive economic growth (Glasgow City Council, 2020a) and rather than viewing the CE transition as a way of radically transforming our economic and political systems, the city council is focussed on stimulating change within the boundaries of capitalism just transitioning away from the dominant neoliberal and globalised system.

5.2.6. Circular Economy policies

The main policy areas proposed by Glasgow are in the areas of education and knowledge development (75%) and governance and municipal operations (72%). Within the CE route map, there is a strong emphasis on raising awareness to change consumer behaviour and encourage the reuse, repair and sharing of goods, and developing the skills base and knowledge needed for the CE transition through various reskilling and upskilling programmes, education in schools and within the city council itself. Furthermore, other policy areas explored within the CE route map are transport and mobility (30%), food and organic waste streams (30%) and renewable energy (30%).

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%). However, similar to Amsterdam, the CE is still in its infancy and is thus at an exploratory phase, with many pilot projects, and collaborative experiments taking place alongside businesses, universities and other key actors. In the future, these projects may be upscaled to become the mainstream, leading to stronger action.

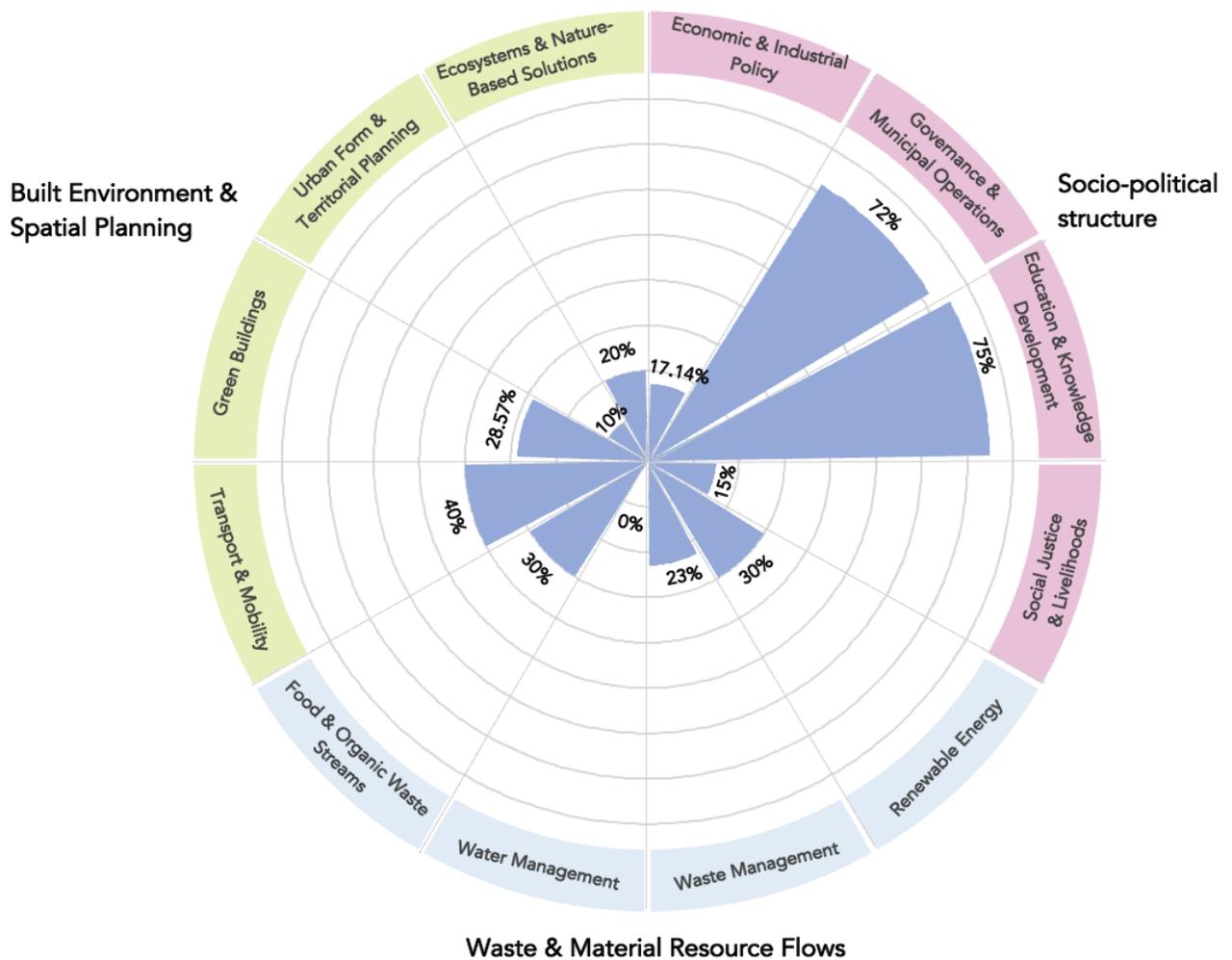


Figure 5.5: Policy areas addressed within Glasgow's CE route map

Waste and material resource flows

There is a minimal level of commitment from Glasgow City Council concerning waste and material resource flow policies. For example, there are no **water management** policies included in the CE route map. There are a number of **waste management** policies within the CE route map with varying levels of commitment. For instance, Glasgow City Council is committed to the supporting the creation of a secondary materials market through the development of a circular construction statement, a last-mile low carbon delivery system and a virtual business exchange platform (Glasgow City Council, 2020a). However, the city council only mentions the potential use of urban industrial symbiosis, with no real action taken besides a partnership project with the London Waste and Recycling Board (LWARB) to the use of textile waste. Glasgow is similarly committed to policies in the food and organic waste stream policy area and the renewable energy policy area (Glasgow City Council, 2020a). With **food and organic waste stream** policies, Glasgow City Council are running a voluntary city-wide scheme to support and help businesses use sustainable, low-carbon and local produce and through the Glasgow food growing strategy, the council is helping citizens gain access to community growing opportunities, for instance (Glasgow City Council, 2020a). With **renewable energy** policies, Glasgow City council is working to support decentralised renewable energy production through the Local Heat and Energy Efficiency strategy (LHEES) which explore opportunities and requirements to commence local and district heating networks and assist the uptake of community energy projects in the city. Glasgow City Council also mention the need to move towards an economy based on renewable energy, however, no specific steps are outlined here (Glasgow City Council, 2020a).

Built environment and spatial planning

Unlike Amsterdam, Glasgow includes more and is more committed to the built environment and spatial planning policies. Within the **transport and mobility** policy area, the city council is expanding the current bike and electric car hire services, supporting the Glasgow metro initiative to improve public transport infrastructure across the city and are even exploring the possibility of developing a public transport system that is free of charge (Glasgow City Council, 2020a). With **urban form and territorial planning** policy, the city council is concerned with creating a 20-minute city in Glasgow through its Liveable Neighbourhoods programme. However, progress is in its early stages and is, thus far, relying on communities to drive change within their own communities with only limited support (Glasgow City Council, 2020a).

In terms of **green buildings** policy, despite a lack of strong action, Glasgow City Council is taking various actions. For example, the city is participating in the EU CIRCUIT project which aims to upscale the adoption of circular construction techniques, exploring circular construction opportunities through LHEES and taking advantage of vacant council units to create incubator co-working facilities for circular businesses and start-ups (Glasgow City Council, 2020a). Lastly, with **ecosystems and nature-based solutions** policies, Glasgow City Council is looking to open up unused vacant and derelict land to provide more green spaces in the city and room for community gardening (Glasgow City Council, 2020a). However, beyond this, there are no other policies or actions noted.

Socio-political structure

In terms of **social justice and livelihood** policies, the council only focuses on promoting sharing and repair activities, predominantly through partnerships and pilot projects, with no action towards improving access to amenities for its citizens or fostering the creation of community or social housing included, for example (Glasgow City Council, 2020a). Glasgow City Council is committed to various **governance and municipal operations** policies. For example, the city council is prioritising circular practices, business models and eco-design within their procurement and tender processes and is working to make their schools and the local healthcare sector more circular (Glasgow City Council, 2020a). Furthermore, Glasgow City Council is also participating in, as mentioned, various public-private partnerships and is collaborating and connecting with other circular cities around the world to share findings and find inspirations. In terms of creating or improving environmental standards, the city council has established (and is in the second phase of) its implementation of a low-emissions zone for vehicles (Glasgow City Council, 2020a). Similarly, Glasgow City Council is committed to various **education and knowledge development** policies, for example, they are working with ZWS to implement a CE communications strategy to influence consumer behaviour and with the organisation, Hubbub, to promote the reuse, repair and sharing of goods (Glasgow City Council, 2020a). Moreover, Glasgow City Council is a partner in various reskilling and upskilling programmes to promote capacity building and knowledge development and have embedded teaching on the CE within nursery and primary school curriculums (Glasgow City Council, 2020a). Lastly, with **economic and industrial** policies, Glasgow City Council have mentioned and discussed various ideas with 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, giving rent reductions, and even the possibility of occupying a vacant council building free of charge (Glasgow City Council, 2020a). Glasgow City Council also mentions the use potentially of cooperatives. However, they are not being implemented in practice within the CE route map. (Glasgow City Council, 2020a).

Policy-discourse type

Overall, based upon the policies proposed within the CE route map, Glasgow is most strongly aligned with the RCS discourse (57.3%) and is to some degree aligned with the TCE discourse (31.7%), indicating a strong level of optimism about the role of technological innovation in preventing economic collapse and a rather solid inclusion of socio-political concerns within its the CE polices (Figure 5.6)

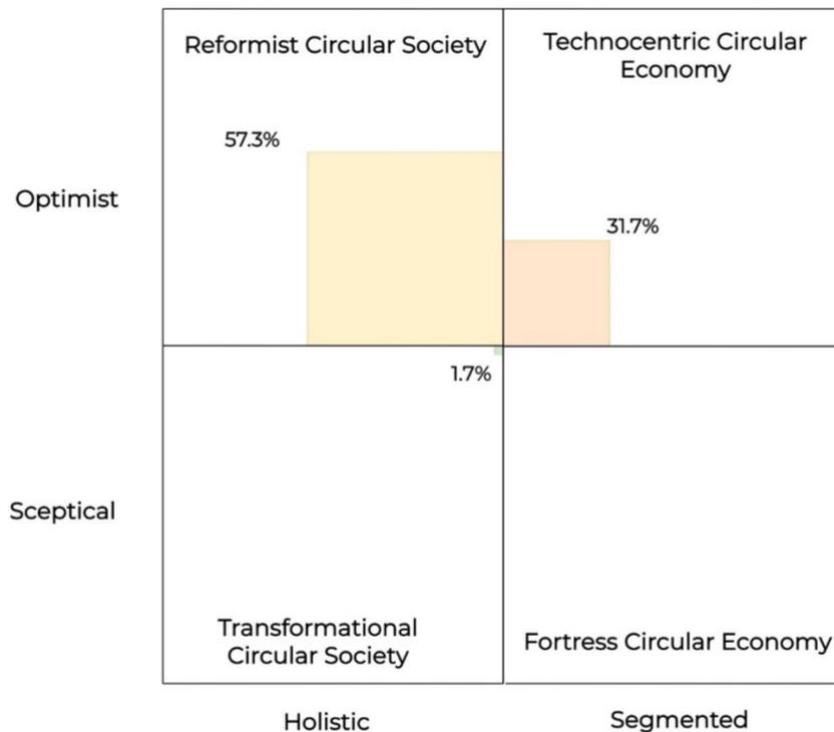


Figure 5.6: Glasgow discourse typology

5.2.7. Governance of the Circular Economy

Participation and deliberation

Creation of the CE route map was neither a participatory nor deliberative process despite the route map discussing the need for inclusivity and participation on behalf of its citizens in the CE transition who have not been allowed to have a say on what type of circular future they would like to have (Glasgow City Council, 2020a). The creation of the CE route map was primarily led by Glasgow City Council, with some assistance from GCC and ZWS who provided input and guidance on what had been achieved in Glasgow thus far and where Glasgow can have the most influence in terms of different sectors of industry and business (Glasgow City Council, 2020a; Inspiring a Circular Glasgow, n.d.)

Modes of governance

Glasgow City Council are governing the CE predominantly through enabling, provision and self-governing (Table 5.2). In particular, Glasgow City Council is heavily focussed on enabling through facilitating partnerships and collaboration with key organisations such as the EMF, C40 cities, OECD, LWARB, and Circle Economy, primarily in the key sectors such as education and knowledge development and green buildings, for example (Glasgow City Council, 2020a). On the other hand, when governing by provision, Glasgow City Council provides circular businesses and start-ups with financial support and other resources, develops and expands on existing infrastructure such as roads, and can develop local and district heating networks, for instance (Glasgow City Council, 2020a). With self-governance, Glasgow City Council primarily focus on the development of its circular procurement and tender processes, with some action towards improving the circularity of its public schools and hospitals (Glasgow City Council, 2020a). Lastly, in terms of governing by authority, change is not legally enforced beyond the implementation of a low-emissions zone in the city centre. This is despite GCC noting that voluntary action is not 'the most robust course of action' and discussion within the CE route map about the impact that planning and enforcement regimes could have in the CE transition (Glasgow City Council, 2020a).

Table 5.2: Modes of governance used in Glasgow with examples of policies

Mode of governance	Example of policies (Glasgow City Council, 2020a)
Self-governance	<ul style="list-style-type: none"> - Prioritising circular practices and business models and eco-design in their procurement processes - City council carbon literacy training and upskilling programme - Implementation of plastics strategy in schools and the healthcare sector
Enabling	<ul style="list-style-type: none"> - Sustainable food business scheme - Public-private partnerships with partner cities, businesses, NGOs etc. - Circular construction and textiles forum - Awareness raising activities with ZWS and Hubbub - Virtual exchange business platform
Provision	<ul style="list-style-type: none"> - Local Heat and Energy Efficiency Strategies (LHEES). - Providing derelict and vacant land for citizens to develop green spaces - Kickstarter fund for circular businesses and innovators - Rolling out and expanding city wide bike hire scheme - Expanding active travel infrastructure
Authority	<ul style="list-style-type: none"> - Enforcing a low emissions zone in the city centre, with entry fee for polluting vehicles (exemptions for low-income earners)

5.3. Cross case analysis

5.3.1. Words versus action

Generally, RCS and TCE discourses tend to dominate in Amsterdam and Glasgow. However, Glasgow is more aligned to the RCS discourse type than Amsterdam despite the city intentionally utilising the Doughnut economic model to create a more holistic vision of the CE which puts citizens prosperity and wellbeing first (Municipality of Amsterdam, 2020a, 2020d). Nevertheless, in both Amsterdam and Glasgow, there is a discrepancy between what is said in the respective CE strategies and what is done in practice. Within Amsterdam’s CE strategy, the RCS discourse is most prevalent, however, according to the findings from the policy-discourse framework, Amsterdam is generally ambivalent concerning the inclusion of socio-economic and political concerns in the CE, with the policies aligning with the RCS and TCE discourse types. Furthermore, despite strong calls for action in Amsterdam’s CE strategy, the majority of action taken involves carrying out and supporting research programmes, pilot projects, and urban living labs (Glasgow City Council, 2020a, 2020c). This may be the city wanting to uphold its status as a progressive, forward-thinking, and innovative city and role as a type of policy entrepreneur. However, it also may be due to the fact that, as mentioned, the CE is still in its infancy and is thus at an exploratory phase.

There are also similar concerns in Glasgow but, generally, the policies in Glasgow are mostly reflective the RCS discourses found in the CE route map. Nevertheless, Glasgow City Council see themselves as a facilitator in the CE transition, resulting in a significant amount of responsibility passed on to market actors. This method of governing contradicts the city council’s criticism of neoliberalism which notes the harmful impacts of reduced power and resources for local government (Glasgow City Council, 2020a). Moreover, the city council consistently reiterates throughout the CE route map its concern for equality, wellbeing and the inclusion of citizens with political processes at the city level, noting the role that participation plays in facilitating the transition to a CE (Glasgow City Council, 2020a). However, in practice, Glasgow City Council does not utilise

any participatory and deliberative governance mechanisms and they did not include citizens in the creation of the CE route map itself. These findings are consistent with those of Calisto Friant et al. (2021), who found in their paper concerning circular economy policies at the EU level that 'talk' is in the optimistic and holistic framing of RCS discourses while 'action' falls within the segmented and optimistic typology framing of TCE discourses.

5.3.2. Governance of the Circular Economy

Amsterdam and Glasgow both utilise similar modes of governance, namely governing by enabling, provision and self-governance. In particular, both cities engage in and rely on the use of partnerships (specifically public-private partnerships) in order to facilitate knowledge sharing and development and deliver services. The similarities in modes of governance are reflective of wider societal shifts from government to governance since the 1980s with the growth of neoliberalism, which resulted in a greater reliance on market-driven approaches and public-private partnerships (Castree, 2008; Driessen et al., 2012; Lowndes & Pratchett, 2012). The case studies illustrate the various ways local governments and cities more broadly can act as agents of change on their own and through collaboration and interaction with key stakeholders to support the transition to a CE, building upon existing research published concerning the role of local governments in the CE (Bolger & Doyon, 2019; Christensen, 2021; Dagilienė et al., 2021; Gravagnuolo et al., 2019). The results also show how municipalities utilise different modes of governance depending on context and policy area, similar to Christensen (2021) study of local modes of governance the transition towards a circular economy in construction and textile recycling. For example, in Glasgow's education and knowledge development and green buildings policies, governing through enabling is most prevalent.

5.3.3. Perspectives on economic growth, social justice and fairness

In Amsterdam, societal concerns are not addressed through the radical redistribution and circulation of wealth and resources but, rather, the city is focussed on the societal benefits generated from using current resources more fairly and efficiently through the sharing economy and reducing energy bills through improved infrastructure and retrofitting, for example. In Glasgow, societal concerns seem to be a real pillar of the CE approach rather than an extra benefit which is the case in Amsterdam. Indeed, as mentioned, societal concerns such as inequality, deprivation and social exclusion, are addressed in the CE route map through creating inclusive growth (sharing of wealth in the future) which is generated by localising the economy. However, this is done instead of redistributing current wealth and resources.

CE is also realised partly in Amsterdam and Glasgow by establishing business opportunities involving the processes of repairing, reusing and remanufacturing, for example, which bring activities that would be carried out traditionally within the home, with no or low monetary value, within the economy, contributing to GDP growth (Isenhour & Reno, 2019; Johansson & Henriksson, 2020). Underlying this idea is the assumption that GDP growth is possible within a CE (eco-economic decoupling), however, there is myriad evidence that proves it is, in fact, impossible (Albert, 2020; Hickel & Kallis, 2020).

5.3.4. Circular Economy policies

In terms of policies advanced by Amsterdam and Glasgow, both cities have a strong focus on governance and municipal operations, and education and knowledge development (Figure 5.7). In particular, both cities are committed to improving circularity within their public procurement and tender processes, engaging in a variety of public-private partnerships to simulate circular innovation and promote knowledge development, and establish and/or support capacity building through educational programmes and training.

Ecosystems and nature-based solutions, and social justice and livelihood policies are limited in both cities' CE strategies. In Amsterdam and Glasgow, social justice and livelihood policies are mostly concerned with the sharing economy, and with ecosystems and nature-based solutions policies, both show only a limited concern for restoring local biodiversity and creating green infrastructure.

Where Amsterdam and Glasgow differ is their commitment to changing waste and material resource streams. Amsterdam is more committed to influencing food and organic waste streams and, to a lesser extent, waste management. This is mostly in line with municipalities focus on waste streams through the three identified sectors of opportunity. In comparison, Glasgow policies and action reflect a limited concern for waste and resource flow policies, which is a significant departure from other CE initiatives in cities that focus predominantly on this policy area as their sole focus (Marin & De Meulder, 2018; Prendeville et al., 2018). Amsterdam and Glasgow also differ in their commitment to the built environment and spatial planning policies. Interestingly, Glasgow is relatively more concerned with transport and mobility, which is a less discussed and addressed policy area in other CE initiatives in cities (Fratini et al., 2019; Petit-Boix & Leipold, 2018; Prendeville et al., 2018). Indeed, in Amsterdam, issues of transport and mobility are barely touched upon.

Overall, the case studies show how the CE can be implemented and advanced in cities in different ways, in line with previous circular city case study research by (Fratini et al., 2019), (Prendeville et al., 2018) and (Marin & de Meulder, 2018). A fully summary of the policies implemented in Amsterdam and Glasgow can be found in appendix 2.

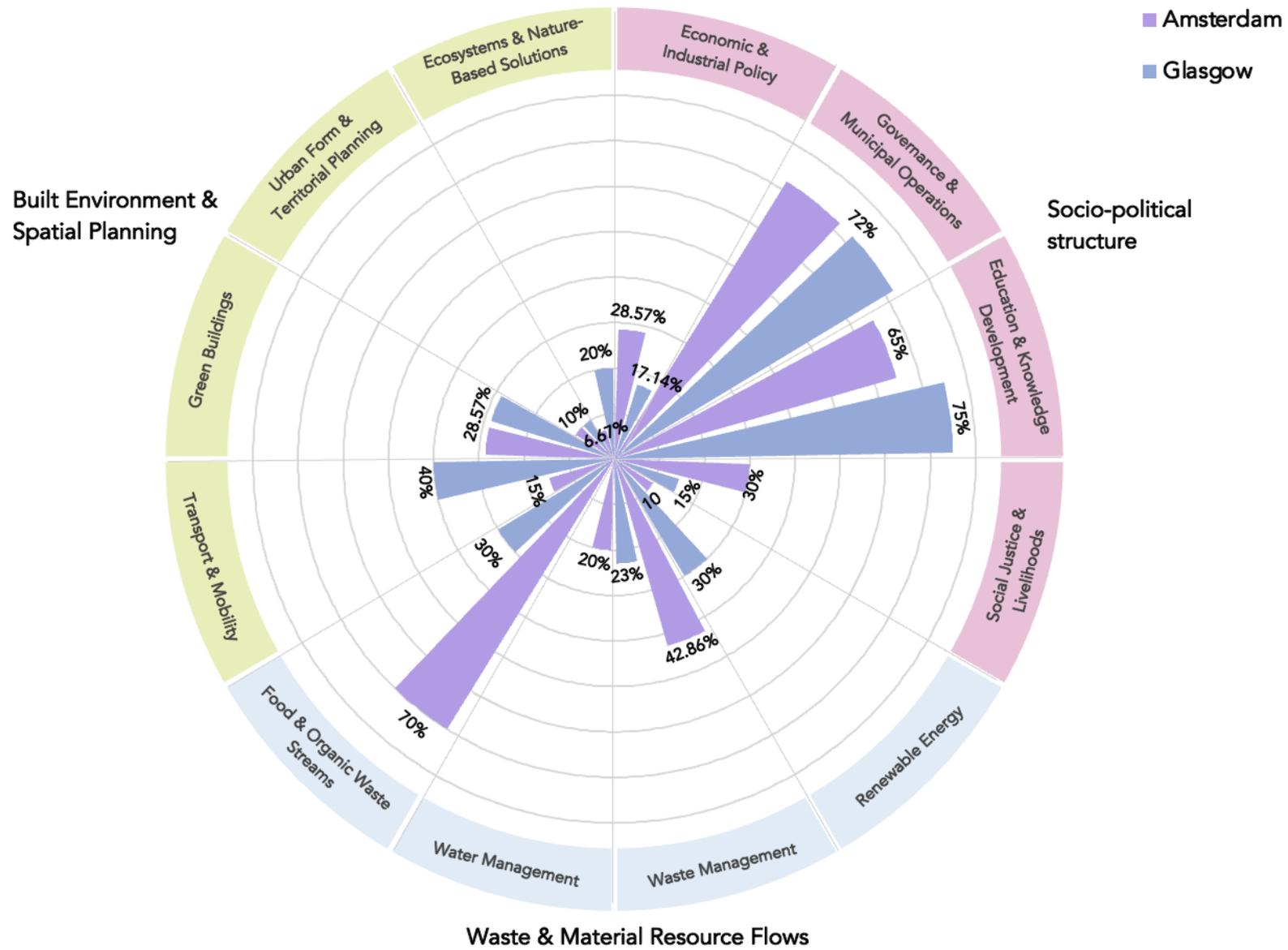


Figure 5.7: Comparison of policy areas addressed in Amsterdam and Glasgow

6. Discussion

6.1. Reflections and implications

This section discusses some of the implications of Amsterdam and Glasgow's CE discourses and policies and reflects on how the discourses and policies proposed in the respective CE strategies relate to their ability to tackle the social, environmental and economic issues prevalent in cities and in society more broadly.

6.1.1. Economic growth and eco-economic decoupling

In both Amsterdam and Glasgow, economic growth is not seen as problematic but rather it is assumed that economic growth will lead to development and the achievement of their social goals, as mentioned. As such, there is the assumption that within the transition to a CE, economic growth can be separated from environmental degradation i.e., eco-economic decoupling, which is reflective of both city's alignment to the RCS and TCE discourse types. However, the assumption that eco-economic decoupling is possible is problematic as decades of scientific literature has found that absolute decoupling is, in fact, impossible and incompatible with wider circularity and climate ambitions (Albert, 2020; Hickel & Kallis, 2020). Indeed, especially with Glasgow and its criticism of neoliberalism and concern for poverty and inequality, by leaving economic growth unquestioned, the cities fail to address the origins of the issues they want to address and do not fundamentally disrupt the status quo in terms of politics, power and norms (Giampietro & Funtowicz, 2020; Hobson & Lynch, 2016).

Proponents of eco-economic decoupling believe that recycling, refurbishing and remanufacturing, for example, can lead to the creation of perfectly circular cycles. However, in reality, materials will degrade in quantity and quality over time as they are cycled or used and through each cycle of the recovery process, significant amounts of energy will be consumed (Albert, 2020; Haas et al., 2015). Furthermore, not all materials can be recycled easily and some not at all, meaning that consumption is still dependent upon natural resource extraction. There is also the risk that rebound effects if the expected efficiency gains associated with technological innovation are cancelled out or reduced by behavioural changes (Bauwens et al., 2020; Cullen, 2017; Korhonen et al., 2018). Thus, overall, it is impossible to create a full circular industrial system. Glasgow and Amsterdam should not pretend that decoupling and continued economic growth is possible and, instead, focus more on the shorter loops of the CE value retention hierarchy (e.g., refuse, reduce, repair).

Realistically, questioning economic growth and decoupling is not politically acceptable (Hickel & Kallis, 2020; Ortega Alvarado et al., 2021). Economic growth is supported by the belief that the accumulation of wealth results in greater wellbeing so going against the grain of economic growth can be perceived to some as the rolling back of earned economic and social gains and the loss of a collective quality of life that is enjoyed by some and is the aspiration for many (Hobson & Lynch, 2016). However, rather than doing without, the goal instead for Amsterdam and Glasgow should be making more of what they already have or have the potential to have (Hobson & Lynch, 2016) and, ultimately, by questioning and problematising economic growth and decoupling, questions can emerge concerning which goals and values could drive alternative visions of the CE which is key for the evolution of the CE as a concept and its future use.

6.1.2. Social and environmental justice

Despite embracing more socially progressive aspects of the CE in Amsterdam and Glasgow, social concerns are addressed mostly through the sharing economy, job creation and localising the economy, and there is a lack of consideration of the role of citizens and participatory processes, as found in similar studies by Fratini et al., (2019), Gravagnuolo et al., (2019) and Kębłowski et al., (2020). It is important who gets to have a say in decision-making processes, especially when it comes to agenda setting and policy creation. By excluding citizens from 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 Amsterdam and Glasgow's ability to identify and explore radically different futures (Bauwens et al., 2020; Calisto Friant, 2019; Calisto Friant et al., 2020). Through recognising and exploring the diversity in

circularity thinking and visions for the future, a greater range of policies and ideas can come to the forefront to address the plethora of socio-ecological challenges that cities face, which, as mentioned, is key for CE's relevance in the future as a concept (Calisto Friant et al., 2020). Furthermore, as noted in Glasgow's CE route map, if the views and opinions of citizens are not included, they may feel disenfranchised and disempowered by the political system, making the CE transition more difficult (Glasgow City Council, 2020a).

More generally, in Amsterdam and, to some extent, in Glasgow 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 (Calisto Friant et al., 2020; Genovese & Pansera, 2020; Ortega Alvarado et al., 2021). For example, Williams (2021) found in her study of circular development in Amsterdam, London, Paris and Stockholm, that those who benefitted from increased green spaces and infrastructure were predominantly affluent neighbourhoods. In London and Stockholm, for instance, green gentrification had taken place, increasing house and rental prices and, thus, displacing low-income residents from their neighbourhoods. In promoting the sharing economy too, there are potent negative impacts on social inclusion and wellbeing, for instance, the deterioration of secure employment and the elimination of affordable housing in cities (Geissdoerfer et al., 2017; Hobson, 2020; Hobson & Lynch, 2016). It is therefore important that in Amsterdam and Glasgow, local governments and key stakeholders think more clearly about how the CE is governed and who would be advantaged or disadvantaged in the implementation of particular policies or actions, for example.

6.1.3. Circular Economy and sustainability

In Glasgow, the CE is almost synonymous with sustainability. In particular, the CE appears to be an umbrella concept for other environmental policies within the city council. Conceptually and practically, by integrating the two concepts and using them interchangeably, various issues may arise. First, there is the chance that Glasgow may be reframing and reclassifying already existing policies rather than creating shifts in the urban policy agenda, as found in research by Kębłowski et al., (2020) and Prendeville et al., (2018). Second, Geissdoerfer et al., (2017) notes how it may be problematic to use CE and sustainability interchangeably because the CE is not always sustainable. For instance, if the CE is not implemented correctly, considering potential rebound effects from efficiency gains and the amount of energy required to recycle materials, the CE may increase greenhouse gas emissions and, thus, accelerate global warming (Cullen, 2017; Korhonen et al., 2018). Third, if cities equate the CE with sustainability, attention may be driven away from comprehensive, more holistic and transformational approaches. As mainstream conceptualisations of the CE tend to follow TCE discourses, emphasising economic and environmental benefits, policy makers and private business may be more in favour of adopting the CE over sustainability, thus, minimising the social dimension (Clube & Tennant, 2020; Geissdoerfer et al., 2017).

6.1.4. Goals and targets

In both Amsterdam and Glasgow, material and energy efficiency are measured with clear targets and objectives for the future, and have a more robust monitoring system in place. However, concerning the societal dimensions of the CE, there are only broad overarching visions for the future of Amsterdam and Glasgow as progressive and prosperous cities, with no tangible goals or targets. According to Calisto Friant et al., (2021) and Paiho et al., (2020), having concrete goals and indicators is necessary for guiding the transition towards circular cities as they allow progress to be monitored, it can be determined whether the proposed policy solutions are effective or not, and, ultimately, what gets measured tends to get done (Nuñez-Cacho et al., 2018; Raworth, 2018). Taking a more holistic vision of circularity, the city's strategies should promote mandatory targets for the social dimensions of the CE such as job generation, the number of social enterprises and cooperatives working on the CE, and investments in the social and solidary economy, for example (Calisto Friant et al., 2021).

6.1.5. Biodiversity and energy policies

As mentioned, both Amsterdam and Glasgow are limited in their commitment and implementation of ecosystems and nature-based solutions, and renewable energy policies. However, according to the literature, it is essential for the CE transition that ecosystems and energy policies are integrated as, together, they form a 'deeply interrelated nexus' (Calisto Friant et al., 2021, p.348), with action taken in one area inevitably affecting others.

The inclusion of nature-based solutions, in particular, is crucial in addressing various urban challenges in cities such as water management, air quality, human wellbeing, improved biodiversity status and climate mitigation, for instance. Also, as their implementation can have various co-benefits and they are generally multifunctional, nature-based solutions can address and deliver various ecosystem services at the same time (Atanasova et al., 2021) Thus, it is key that these policy areas are included to create more coherent and holistic CE strategies in Amsterdam and Glasgow.

6.2. Recommendations

Based on the results and the conceptual and potential implications of the CE policies and discourses advanced in Amsterdam and Glasgow, the following recommendations are provided (Table 6.1).

Table 6.1: Recommendations for Amsterdam and Glasgow

Number	Recommendation	Elaboration
1	Incorporate participatory and deliberative governance mechanisms such as participatory budgeting and citizens assemblies.	Will include voices of marginalised citizens, improve satisfaction and engagement with local politics, bring together citizens with contradicting views and opinions, and help explore the plurality of CE visions and policies that are possible. Also, through deliberation, Calisto Friant (2019) notes the outcomes tend to be more sustainable and progressive.
2	Establish targets and indicators for the social dimensions of the CE.	By setting social targets and developing indicators, the social dimension of the CE can progress, and improvements can be monitored and can help set direction for future policy.
3	Develop redistributive policies, if possible, and ensure that those already disadvantaged in society are not further burdened in the CE transition	Redistributing power, wealth, knowledge and resources can more equally share benefits of the CE transition across the city.
4	Move beyond the sharing economy to incorporate other societally relevant policies.	Whilst the sharing economy can play a part in developing social capital, there is also the risk that sharing initiatives may undermine real social connection and solidarities (Hobson & Lynch, 2016).
5	Include nature-based solutions and renewable energy policies	Integrating policies on biodiversity, nature-based solutions and energy can develop a more coherent and holistic CE as, together, they form a deeply interrelated nexus to address various socio-ecological challenges (Calisto Friant et al., 2021).

6.3. Research limitations and reflections

Overall, the policy-discourse framework as a method was useful for analysing the CE policies and discourses in Amsterdam and Glasgow. Indeed, the policy-discourse framework identified the range and variety of policies which are possible at the city level in the CE transition and the city's commitments to those policies. Furthermore, the policy-discourse framework was key in highlighting and illustrating the discrepancies in the case studies, for example, between what is spoke about in policy documents and what is actually done in practice.

In the future, the policy-discourse framework could be used by academics to explore how CE is being advanced at the city level in other cities, and by municipalities and other stakeholders to refine and analyse their own city's CE strategies and help raise awareness and understanding of what other CE policies and visions are possible. Moreover, as this research used Amsterdam and Glasgow as case studies to pilot the applicability, effectiveness and construct validity of the policy-discourse framework, future research should

apply the policy-discourse framework to other cities both in Europe and more broadly to further strengthen the method.

There are also several points worth reflection. As mentioned, 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. It is a subjective scale, however, with only a general description of what is considered 'limited' or 'strong' action rather than defining more objective criteria. This general description was generated to account for the different governance structures and thus power and resources between cities in different countries and thus, allow the cities to be scored relative to what is actually possible and within their means. In doing so, the cases can be compared more fairly. However, as the scoring is done subjectively, there is the chance that if one city is analysed by two different individuals, that the results derived would not be the same. Similarly, the nature of assigning the discourse to the policy was generally subjective, decided based on how well the policy would reflect and reproduce one of the discourses and when unsure, the categorical imperative thinking "what if this was the only CE policy implemented by the city?" was used. There is the chance here that different researchers or stakeholders would align a policy with a different discourse type. However, this research has attempted to control for an instance like this by providing a brief rationale for how each policy was assigned its discourse within appendix 3.

A broader limitation of this research is that the case studies were analysed through the application of the policy-discourse framework and a document analysis alone. In order to greater ensure the validity and accuracy of the results and the effectiveness of the policy-discourse framework, other research methods could have been used, for example, interviews. Carrying out interviews with key stakeholders in Amsterdam and Glasgow would ensure that the findings and understanding of the CE in the respective cities is accurate and the interviewees would be able to provide feedback and recommendations for improving the policy-discourse framework (e.g., are any types of policies excluded?).

7. Conclusion

This thesis aimed to investigate the plurality of CE policies and discourses advanced by different European cities and how these policies and discourses can be critically analysed. Overall, as a method, the policy-discourse framework was useful for analysing the CE policies and discourses in Amsterdam and Glasgow. The framework, alongside a more in-depth document analysis, clearly identified the variety of circular policies and discourses that are advanced in the respective cities, measuring each city's commitment to those policies, the circular discourse types they include, and the governance modes and mechanisms are utilised.

Overall, RCS discourses are advanced mainly in Amsterdam and Glasgow, confirming previous work and observations by Calisto Friant et al. (2020), Fratini et al. (2019) and Kębłowski et al. (2020). They note that circularity discourses in cities tend to be more socially progressive than the TCE type discourses that dominate at the national and international scale. However, the research also found that there are differences between how the CE is spoken about on paper and what is done in practice, similar to the findings of Calisto Friant et al., (2021) study of circular policies and discourses in the EU. In Amsterdam and Glasgow, the CE strategies are strongly aligned to RCS discourses. However, this is not entirely reflected in the policies proposed, which tended to be less socially progressive and more technocentric. Indeed, there is a strong focus on governance and municipal operations and education and knowledge development in both Amsterdam and Glasgow. There is also a limited emphasis generally on ecosystems and nature-based solutions, and social justice and livelihoods, confirming previous research which notes that despite cities claiming to embrace more progressive aspects of the CE and presenting a generally holistic approach, CE policies still tend to inadequately include the social dimensions of the CE (Hobson & Lynch, 2016). Thus, reflecting on the policies proposed by each city, it is questionable that they will meet the overarching aims and goals that they are attempting to achieve. In terms of the governance modes used by the different cities to develop and implement circularity policies, generally, the CE is governed through enabling, provision and self-governance, illustrating the various ways local governments can act as agents of change on their own and utilise different modes of governance.

This thesis contributes to the broader academic literature on the CE in cities. So far, the majority of research completed on circularity in cities has explored what indicators could be used at the city level to measure and assess the CE (Gravagnuolo et al., 2019) or have attempted to identify the opportunities and barriers to the CE transition in cities (e.g., Campbell-Johnston et al., 2019). Very few researchers have explored how the CE is advanced and operationalised at the city level regarding policies and discourses and how this can be critically analysed. So, by building on the CE discourse typology developed by Calisto Friant et al. (2020) to develop the policy-discourse framework, this research has been able to fill an important gap in the research. In terms of future research, the policy-discourse framework should be tested in other cities to strengthen and further refine the method.

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Appendix 1

Circularity Discourse	Concepts used
Technocentric Circular Economy	<ul style="list-style-type: none"> • Industrial Ecology • Biomimicry • Bioeconomy • Industrial Symbiosis • Eco-Industrial Parks • Product System Services • Cleaner Production
Reformist Circular Society	<ul style="list-style-type: none"> • Sharing Economy • Cradle to Cradle • Natural Capitalism • Regenerative design • Cyclical Economy • The Natural Step • Material Efficiency
Transformational Circular Society	<ul style="list-style-type: none"> • Ecofeminism • Deep Ecology • Social Ecology • Radical Pluralism • Transition Movement • Degrowth • Buen Vivir • Ubuntu • Ecological Civilisation
Fortress Circular Economy	<ul style="list-style-type: none"> • Disaster Capitalism • Fortress Europe

Appendix 2

Policy Area	Policies	Discourse type	Amsterdam		Glasgow	
Economic and industrial policy	Funding and supporting CE initiatives, entrepreneurs, and start-ups (project grants, subsidies and low-interest loans, tax breaks, enterprise zones, pilot projects, business platforms etc.).	TCE	3	The city engages with and supports a variety of CE initiatives and startups across the three policy areas. For example, helping to test circular innovations at major city events through setting up a pioneer group and cooperation agenda with stakeholders (Municipality of Amsterdam, 2020c, p.178), supporting entrepreneur collectives with their innovative projects (Municipality of Amsterdam, 2020c, p.199), and supporting the Port of Amsterdam to experiment with new circular applications (Municipality of Amsterdam, 2020c, p.184). However, there is a lack of information concerning how they support all the initiatives, for example, do they give the stakeholders special permission to carry out the activities? or help with logistical and organisational matters? or provide financial resources? etc.	5	The city council shows significant commitment to supporting CE initiatives, entrepreneurs, and start-ups. There are three different actions that the council is taking. First, they are supporting circular innovation and start-ups by providing groups with unused properties and rent reductions (Glasgow City Council, 2020a p.111, 63, 86). To identify which properties are appropriate, they will start with conducting a baseline audit of council property. Second, the council is creating a 'Circular Kick Starter Fund' to provide annual financial support, advice, and connections for CE start-ups (Glasgow City Council, 2020a p.111, 86). Lastly, the council is working to support CE projects that are already established but may not survive without further aids. To identify these projects, they will conduct an audit report in collaboration with the relevant stakeholders (Glasgow City Council, 2020a p.112, 86, 88).
	Deregulating and liberalising to support innovation and foreign investment in new CE initiatives and businesses.	TCE	2	The city is giving some support and priority to deregulation and liberalisation in support of innovation and investment in circular initiatives and businesses. Due to the fact that the municipality lacks the power to change broader laws and regulations at the national and EU level, they are collecting information from entrepreneurs (Municipality of Amsterdam, 2020c, p. 189) and working with market actors to help reduce regulatory barriers at the municipal level (Municipality of Amsterdam, 2020c, p.189) and engaging in lobbying activities. Thus, real action to deregulate and liberalise have not yet occurred.		
	Promoting the local production of goods, shopping at local small businesses and the use of cooperative production structures.	TCS	2	The city helps to promote the local production of goods in a circular manner and shopping at local small businesses in 2 ways. First, by supporting Amsterdam Made, a community of 150 manufacturing companies in the metropolitan area, which helps its members to become more sustainable and circular (Municipality of Amsterdam, 2020a, p.53; Municipality of Amsterdam, 2020c, p. 65). Second, by encouraging consumers to shop at local sustainable fashion businesses through promoting such businesses online via a specialised website (Municipality of Amsterdam, 2020c, p. 65). However, more support could be given beyond awareness raising activities and helping to create a sustainability programme such as financial support for incentives, for example.	1	The city council is, to some extent, invested in promoting the local production of goods, shopping local and the establishment of co-operative structures. Glasgow City Council aims to promote social inclusivity through community ownership models, such as co-operatives (Glasgow City Council, 2020a p.76) and to, generally, localise the economy (Glasgow City Council, 2020a p.98/99). The first step involves producing a 'Social Economy' vision document which will act as a 'think piece' and provide examples of best practice for creating a socially circular and innovative local economy (Glasgow City Council, 2020a p.118). This is a good start. However, no real concrete action is taken to promote local production and build co-operative structures beyond this 'think piece' thus far.
	Encouraging and creating the capacity for deindustrialisation and local autonomy	TCS				

	(traditional labour-intensive production of basic needs such as food, tools, clothing, energy, and housing).					
	Improving eco and material efficiency by promoting and encouraging the use of high-tech communication technologies (smart meters, fibre optics, AI/machine learning, 3D printing, smart LED lighting, automation etc.)	TCE	3	The city is establishing and/or supporting a plethora of research programmes testing the use of high-tech innovations in the transition towards CE. For example, the use of AI in vertical farming (Municipality of Amsterdam, 2020c, p.30), and the use of digital production techniques such as robots and 3D printing (Municipality of Amsterdam, 2020c, p.146). The city is also already utilising some smart technologies to improve eco and material efficiency, for example, establishing a CE data platform that helps citizens, governments, and businesses to make sustainable choices (Municipality of Amsterdam, 2020c, p.194), and collaborating with stakeholders, using communication technologies to map food flows and reduce food waste (Municipality of Amsterdam, 2020c, p.55). However, as the city is testing the use of high-tech communication technologies more than their real use, actions could be stronger.		
	Shifting public services to the private sector (housing, water provision, energy etc.) to improve cost-efficiency.	FCE				
	Expropriating, dispossessing, and displacing poor communities for economic development (gentrification) or for building infrastructure for disaster risk reduction.	FCE				
Governance and municipal operations	Establishing and facilitating participatory mechanisms for the development, governance, and implementation of CE-policies (such as participatory budgeting, referendums, and citizen councils).	RCS	2	The city is, to a limited extent, facilitating the establishment of participatory mechanisms in the transition towards CE. The municipality note the desire to create an urban agriculture citizen collective to make process more democratic (Municipality of Amsterdam, 2020c, p.37), are drawing up a commons agenda with residents to investigate how two neighbourhoods can become more circular (Municipality of Amsterdam, 2020c, p.104) and are investigating different types of ownership and cooperation agreements in the context of CE (Municipality of Amsterdam, 2020c, p.97). However, these are three small projects and there is little detail provided about how these participatory mechanisms will work in practice.	1	Glasgow City Council expresses the desire to become a co-operative council through devolving power to its citizens (Glasgow City Council, 2020a p.50) and creating more inclusive economic growth through processes such as participatory budgeting (Glasgow City Council, 2020a p.69). However, no concrete action is being taken to advance these aims and ambitions.
	Establishing and/or facilitating collaborative governance mechanisms with industrial and other actors to improve eco-efficiency (such as Public-Private Partnerships, multi-stakeholder partnerships and extended producer responsibility organisations).	TCE	5	The city is establishing or participating in over 20 public-private partnerships, particular concerning food & organic waste, the built environment, and textiles. For example, the metropolitan area food council (Municipality of Amsterdam, 2020c, p.55), the Green Business Club Zuidas (IP, p.84) and a circular textile partnership (Municipality of Amsterdam, 2020c, p. 72/73). Further, the municipality are also collaborating with other international cities through, for example, C40 cities (IP, p.198), Climate-KIC Innovation agenda (Municipality of Amsterdam, 2020c, p.200) and CIRCLES (p.167), and with partners at the national and international level to influence CE policies in Amsterdam and beyond. For example, the 'Accelerating together' programme which has brought together 4 municipalities, government organisations and large construction companies to improve circularity in the construction industry (Municipality of Amsterdam, 2020c, p.147).	5	Glasgow City Council is committed to establishing and facilitating collaborative governance mechanisms, such as public-private partnerships. The council is considering and, in some cases, working towards building formal partnerships and fostering collaboration through, for example, mayoral covenants with partner cities (Glasgow City Council, 2020a p.106), engaging with the business community to establish more circular practices (Glasgow City Council, 2020a p.88/89) and working with political bodies, and public sector to create a network where resources, materials and facilities can be shared and linked (Glasgow City Council, 2020a p.80). The city is also a key actor in the EU CIRCUIT Project (p.108), is delivering partnership projects through their Reskilling and Upskilling programme (Glasgow City Council, 2020a p.114) and the Glasgow Food Policy Partnership (Glasgow City Council, 2020a p.89).

	Establishing municipal monitoring and evaluation systems, utilising data and information on key material and energy flows (e.g., pollution discharges, traffic flows, industrial symbiosis exchanges etc.).	TCE	5	The city is creating a monitoring and evaluating system, in the form of a data platform, to look at the use of materials and the cycles they go through and to show the extent to which the economy in Amsterdam is circular (Municipality of Amsterdam, 2020c, p.196). The municipality is also wanting to better map and model industrial waste streams (Municipality of Amsterdam, 2020c, p.78). Details of how these monitoring tools will be implemented are quite vague as these actions remain at an initial stage. They are nonetheless significant contributions towards monitoring and evaluating to improve eco-efficiency and map impact.	5	The city council are carrying out various municipal monitoring and evaluating development projects. For example, the council is working to develop a monitoring and evaluating tool to measure progress towards the CE in Glasgow, based on Scottish national guidance (Glasgow City Council, 2020a p.106), they are developing a series of metrics to identify a baseline of circular practices within their tender awards (Glasgow City Council, 2020a p. 95) and they are also developing their own City Doughnut to analyse Glasgow's social and ecological boundaries (Glasgow City Council, 2020a p.114). Furthermore, the city is concerned with gathering information about material and waste streams at events, which will help create metrics and provide solutions for decarbonising and reducing waste (Glasgow City Council, 2020a p.113, 91).
	Creating or improving environmental standards on pollution, emissions, energy, and resource efficiency with effective auditing mechanisms.	TCE	1	The city is showing limited commitment towards creating or improving environmental standards on pollution, emissions, as it only has a small initiative to promote sustainability criteria for sports clubs (Municipality of Amsterdam, 2020c)	3	The city council is generally interested in improving environmental standards, notably air pollution and car emissions. They are in the process of implementing a low-emissions zone in the city, with phase 2 to commence between February and May 2022. This will involve all vehicles having to meet specific exhaust emission standards to avoid a penalty charge unless exempt (Glasgow City Council, 2020a p.36, 87). However, the city could expand its efforts to improve and set standards concerning energy and resource efficiency, for example, as well.
	Circular management of public goods and infrastructure through public procurement, public tenders, product-service systems and/or building as a service (for office space, lighting, heating/cooling, communications, electronics, carpeting, cleaning, etc.).	RCS	5	There is significant focus within the municipality on green public procurement and the use of the tender process to encourage the transition towards CE in Amsterdam. This includes 3 actions in the transport sector, 7 in the built environment sector, 4 related to consumer goods/products, 1 related to social care and 1 related to the arts sector. For example, the city is making its transport fleet more sustainable (Municipality of Amsterdam, 2020c, p.192), is making a commitment to 100% circular procurement by 2030 (Municipality of Amsterdam, 2020c, p.204) and is including sustainability an important factor in its tender processes (Municipality of Amsterdam, 2020c, p.162, 69). Further, the city is dedicated to making public spaces and buildings more circular through producing circular street furniture (Municipality of Amsterdam, 2020c, p.113), and testing new circular building techniques on 3 municipal buildings (Municipality of Amsterdam, 2020c, p.118), for example.	4	Glasgow City Council has a key focus on green public procurement and is using the tender process to encourage the transition towards CE. The council reviewing the existing sustainable procurement practices and identifying best practices to provide a baseline across the council (Glasgow City Council, 2020a p.116) and are prioritising circular practices and business models, and eco-design in the procurement process (Glasgow City Council, 2020a p.116). For example, they have set out that suppliers must demonstrate their sustainable credentials to a maximum of 10% of their tender (Glasgow City Council, 2020a p.95). Furthermore, the council is working to make schools and healthcare more circular. For example, through the council's Plastics Strategy, they are looking at the use of plastics in school kitchens (Glasgow City Council, 2020a p.84/85), and they are engaging in discussions with healthcare operators to identify opportunities to implement more circular practices (Glasgow City Council, 2020a p.118). The council also wants to reduce its waste and promote reuse by carrying out baseline waste audits (Glasgow City Council, 2020a p.85). Overall, these actions will make good progress within the council. However, the city could be more ambitious concerning the extent to which it will prioritise circularity within its procurement practices.
	Establishing and/or supporting communication initiatives for awareness-raising and behavioural change that	TCE		The city is engaging in some communication initiatives for awareness raising and behaviour change. For example, supporting a healthy weight programme to promote the transition		Glasgow City Council will raise awareness of the CE in Glasgow in various ways. First, alongside Zero Waste Scotland, the council will implement their Circular Economy

Education and knowledge development	improve material and resource efficiency (e.g., launching media campaigns or education programmes to improve household sorting of waste).		3	to healthier and sustainable diets (Municipality of Amsterdam, 2020c, p.37), and researching the utility of a true pricing tool to make consumers aware of the hidden ecological and social costs of products (Municipality of Amsterdam, 2020c, p.148). Further, the municipality will use public advertising spaces to encourage the sharing, repairing and reuse of products, joining up with national initiatives and other municipalities (Municipality of Amsterdam, 2020a, p.57). However, these actions are limited and could go beyond behaviour change research projects and encompass other policy areas.	5	Communications Strategy in order to help to raise awareness and impart knowledge and understanding to change consumer behaviour (Glasgow City Council, 2020a p.119). Second, the city council will be embarking on public awareness-raising campaigns with Hubbub to promote reuse, repair and sharing of goods (Glasgow City Council, 2020a p.83). Lastly, alongside its Waste Strategy team, the city council will raise awareness concerning waste reduction. They will highlight the cost to the city of processing waste and note how they could use that money for more 'productive and meaningful services for the citizens' (Glasgow City Council, 2020a p.85).
	Fostering cultural transformation towards holistic ecological and social worldviews through community-owned media sources, restrictions on advertisements, promotion of non-materialist values and community ethics etc.	TCS				
	Establishing and/or supporting training, capacity building and education initiatives to spread the technical skills and knowledge needed for a circularity transition	RCS	5	The city is establishing and/or supporting various education and capacity-building initiatives or programmes, particularly in the area's circular jobs/skills (5 actions) and the built environment (2 actions). For example, on a broader scale, the municipality supports House of Skills, a private public partnership which seeks to make the labour market more skills-based, which is needed for the transition to CE (Municipality of Amsterdam, 2020c, p. 202), and the Werkbridge, a facility which assigns jobseekers' assignments within the municipality that contribute towards the CE (Municipality of Amsterdam, 2020c, p.202). In terms of the specific policy areas, the municipality is working with the Engineering department in develop their expertise concerning circular and sustainable design (Municipality of Amsterdam, 2020c, p.125) and is supporting and educating residents to realise their circular housing ambitions (Municipality of Amsterdam, 2020c,, p.140).	5	The city council is dedicated to establishing and supporting education and capacity building initiatives and does so in various ways. First, through their reskilling and upskilling programme involving the delivery of partnership projects to provide training and reskilling in the guiding principles of the circular economy (Glasgow City Council, 2020a p. 114). Second, through supporting education providers to embed the principles of circularity in nursery, primary and secondary schools, mainly through workshops and collaboration projects (Glasgow City Council, 2020a p. 115). Third, through their Carbon Literacy training and upskilling programmes (p.95/96), building capacity and awareness within the council on CE. They also mention the role of apprenticeships and certification schemes in the CE transition (Glasgow City Council, 2020a p.91). Lastly, through its Biodiversity and Ecological Emergency programme, Glasgow City Council is expanding biodiversity learning and promoting local growing within communities and schools (Glasgow City Council, 2020a p.97, 117).
	Establishing or supporting CE research, innovation and knowledge development through collaboration platforms, knowledge hubs, research projects ('urban living labs', 'fab labs', 'Smart citizen labs' etc.).	RCS	5	The city is establishing and/or supporting a plethora of CE research and knowledge development programmes and collaborations across the different policy areas, particularly, the built environment (7 actions), food and organic waste (2 actions), and data and logistics (3 actions). For example, research into the applicability of timber construction in Amsterdam (Municipality of Amsterdam, 2020c, p.91), the hydrogen marketplace (Municipality of Amsterdam, 2020c, p.181), research into the solutions for extending the lifespans of bridges and quay walls (Municipality of Amsterdam, 2020c, p.113) and the Tuinen van West living lab (Municipality of Amsterdam, 2020c, p.30). Thus, significant action has been taken in this area.	5	The city council is working to establish and/or support CE research, innovation, and knowledge development by developing circular economy platforms and forums. The city will create two main forums based on circular construction and circular textiles. The circular construction forum will support knowledge exchange and upskilling between designers, contractors, and architects to promote modular planning, sorting, diagnosis, and recovery of resources (Glasgow City Council, 2020a p.82, 108). The circular textiles forum will work to reform the city's approach to clothing supply and textile waste (Glasgow City Council, 2020a p.108) by building upon a previous city forum in collaboration with clothing social enterprise ApparelXchange (Glasgow City Council, 2020a p.90). The city is also developing a Circular City Platform to help connect all organisations and individuals in Glasgow working on CE to

					foster collaboration, share knowledge and materials (Glasgow City Council, 2020a p.119).
Social justice and livelihoods	Fostering inclusivity and social justice by guaranteeing equal access to urban infrastructure and services (e.g., welcoming refugees, building accessible infrastructure, and securing access to quality education, healthcare, recreational facilities, cultural and artistic activities etc.).	TCS	1	The city mentions in one action the ambition to make the Indische Buurt neighbourhood more sustainable (Municipality of Amsterdam, 2020c p.135), tackle poverty and improve quality of life, however, there is no information about how this will be achieved.	
	Promoting and building community housing, social housing, housing cooperatives and community land trusts.	TCS	2	Only with a pilot project in Buiksloterham is the municipality focussed on developing houses with medium and social rent (Municipality of Amsterdam, 2020c, p.103) and concerning community-land trusts, the municipality is only carrying out research into what they would mean for strategic commissioning and alternative business cases (Municipality of Amsterdam, 2020c, p.104). Alternatively, strong action in this area would show significant commitment to facilitating more affordable and social housing in Amsterdam, for example, through building contracts or rent controls, and provide support to communities who want to establish a community land-trust.	
	Encouraging and supporting the creation of local currencies and cooperative banking to support CE-related activities.	TCS			
	Promoting sharing economy activities (repair cafés, fab labs, swap shops, second-hand shops, zero-waste café etc.) by providing resources, infrastructure, and digital platforms.	RCS	3	The city has 3 projects to promote a sharing economy. Its biggest projects are the development of a circular recycling centre which will be a recycling point/craft centre/second-hand construction market and a training facility to raise awareness amongst citizen about sharing and reuse (Municipality of Amsterdam, 2020c, p. 83) and research by the university of applied sciences into creating a 'vision of things' for the future that will focus on the transformation of the current system around waste and reuse (Municipality of Amsterdam, 2020c, p.71). The municipality is also making sports equipment for kids available for sharing (Municipality of Amsterdam, 2020c, p.67). However, these actions are small pilot projects or partnerships which, at present, will not foster the creation sharing economies in Amsterdam.	3 Glasgow City Council is taking a number of actions to promote Sharing Economy activities. The city is initiating three pilot projects to support the delivery of culture of repair and maintain particular amongst SMEs, communities, and the education sector (Glasgow City Council, 2020a p.109). Similarly, the council is piloting at least one reuse scheme within the city to test the feasibility of recovery and reuse of materials by citizens, including logistical issues such as handling and storage (Glasgow City Council, 2020a p.110). They are also considering creating a central municipal storage facility to house items for reuse (p.110, 83, 84). The Council is engaging in several partnerships to promote sharing economy activities. In collaboration with Zero Waste Scotland, the council is investigating the possibility of using empty units in the city centre to create a community workshop, trading, refit, repair, and remanufacturing base (Glasgow City Council, 2020a p.86). They are also working with LWARB to support the growth of new opportunities to share, repair, reuse and upcycle waste textiles and clothing (Glasgow City Council, 2020a p.90). Thus, overall, the city is making some progress in promoting sharing economy activities. However, the actions outlined consist mainly of small pilot projects or research projects rather than city-wide initiatives.
Renewable energy	Establishing and/or supporting centralised renewable energy production infrastructure (rooftop solar, wind, geothermal etc.).	TCE	1	The city is only briefly addressing the development of centralised renewable energy infrastructure through its support and participation in a single research project by the Institute of Sustainable Process Technology which is investigating the possibilities for a green hydrogen plant in 5 industrial regions in the Netherlands (Municipality of Amsterdam, 2020c, p.183)	1 The city council mentions the need to develop a strategy that identifies the impact of transitioning to a new economy based on renewable energy systems (Glasgow City Council, 2020a p.97). However, no steps are outlined to meet this goal or advance renewable energy use more broadly.

	Promoting decentralised community-owned renewable energy production.	RCS			2	Glasgow City Council promotes the development of decentralised, community-owned renewable energy by ensuring the projects emerging in the Local Heat and Energy Efficiency Strategy (LHEES) are aligned with circularity principles (Glasgow City Council, 2020a p.115). LHEES, amongst other things, will explore opportunities and requirements to commence local and district heating networks and assist the uptake of community energy projects in the city to localise energy supply, combat fuel poverty, and give citizens more autonomy ((Glasgow City Council, 2020a p.93). Whilst LHEES are funded and enforced by the Scottish Government, local councils have the freedom to set their aims and ambitions. Nevertheless, it is unknown whether the city would be focussed on decentralised, community-owned renewable energy if the Scottish Government had not required them to implement a LHEES.
Waste management	Improving waste separation, collection, processing and recycling infrastructure and processes.	TCE	4	The city is taking around 7 different actions towards improving waste separation, collection, processing, and recycling infrastructure. These steps range from pilot projects which, for example, look at efficiency in residual waste collection (Municipality of Amsterdam, 2020c, p. 192), to directly improving access to infrastructure by installing more underground waste containers (Municipality of Amsterdam, 2020c, p.67). Further, through the tender process, the municipality is pressuring the market to come up with more innovative solutions for the sustainable collection of industrial waste (Municipality of Amsterdam, 2020c, p.45). However, whilst the actions focus on improving waste separation and collection, a number of the actions are pilot projects or in early stages of development and/or do not operate at the city-wide scale.		
	Fostering the creation of an efficient secondary materials market through material passports and banks, digital technologies and storage and logistics infrastructure.	TCE	5	The city is dedicated to fostering the creation of an efficient secondary materials market, particularly in the context of creating a circular built environment and dealing with consumer goods. There are 6 projects at the moment which are working to develop digital platforms for the secondary materials market (Municipality of Amsterdam, 2020c, p.197, p.145) and are investigating how new technologies, AI and other digital support products can be used and connected to complement a digital materials market (Municipality of Amsterdam, 2020c,p. 145, p.69).	5	Glasgow City Council is taking various actions to foster and support the creation of an efficient secondary materials market. First, via the Circular Construction Statement, the council is developing a municipal material passport that would help coordinate and catalogue all materials in construction projects in Glasgow (Glasgow City Council, 2020a p.107, 81). Second, the council is supporting and developing a 'last mile low-carbon delivery system' in the city centre. This will first involve carrying out a feasibility study to identify reverse logistics opportunities for the capture and distribute materials for reuse (Glasgow City Council, 2020a p.112). Third, Council is establishing a virtual exchange business platform to match up waste streams and material inputs, with the information provided informing a database of materials (Glasgow City Council, 2020a p. 112). Fourth, by developing an online circular platform to connect citizens and organisations, a central online material sharing hub will be created (Glasgow City Council, 2020a p.119). Lastly, Glasgow city council is working to develop short-term storage facilities for secondary construction materials through the use of derelict land and void properties. The exact locations will be identified by carrying

					out a land and premises audit (Glasgow City Council, 2020a p.81).
	Establishing incentives to reduce grey (non-recyclable) waste (taxations, pay as you throw structures etc.).	TCE	1	It mentions within the CE strategy that the municipality will give differential rates for the collection and processing of residual waste (Municipality of Amsterdam, 2020a, p.62). However, there is not enough information provided about this ambition.	
	Developing and implementing urban mining activities (material and energy recovery from landfills).	TCE			
	Banning certain single-use packaging (e.g., shopping bags, takeaway containers, coffee mugs, etc.) and encouraging bulk shopping and reusable containers).	TCS			
	Restricting certain single-use packaging (e.g., shopping bags, takeaway containers, coffee mugs, etc.) or replacing them with bio-based and/or compostable ones.	TCE	2	The city has taken limited action towards restricting certain single-use packaging and actions consist of only 2 small actions. One is a pilot project launched to combat packaging and food waste at fast food outlets (Municipality of Amsterdam, 2020c, p. 41), and the second is a research project that looks at designing new value systems around product packaging, including the use of Miscanthus as a packaging material (Municipality of Amsterdam, 2020c, p.71). However, there are little details concerning how these actions can be upscaled.	1 Glasgow city council mentions the need to campaign to reduce disposable packaging use (Glasgow City Council, 2020a p.85). However, no concrete actions are mentioned in the CE routemap.
	Promoting industrial and urban symbiosis and eco-industrial parks for material, nutrient and energy cycling and recovery (e.g., utilisation of excess industrial heat to heat nearby urban areas, waste outputs as industrial inputs etc.).	TCE	3	The city shows some commitment to industrial and urban symbiosis, with around 4 different actions being taken according to the implementation programme. For example, the municipality is supporting research to help SMEs reuse their residual waste (Municipality of Amsterdam, 2020c, p.83) and is supporting the Port of Amsterdam in experimenting with new circular techniques (Municipality of Amsterdam, 2020c, p.184). The municipality themselves are also creating a designated circular hub which will act as a materials depot for new and recyclable materials (Municipality of Amsterdam, 2020c, p.104). However, these actions are mostly pilot projects exploring new methods for use and are not going to be used at scale in the near future.	2 Glasgow City Council is taking limited action to advance the use of industrial/urban symbiosis and eco-industrial parks. The routemap mentions creating new industrial and enterprise parks to bring together circular businesses and foster material and knowledge exchange (Glasgow City Council, 2020a p.86). However, there are no concrete actions noted to meet this goal. Alternatively, Glasgow is also working with LWARB to explore initiatives to remove textile waste from landfill and re-route them as feedstock (Glasgow City Council, 2020a p.90). Nevertheless, this is only one project.
Water management	Encouraging the recovery/recycling of wastewater (as fertiliser, energy, bioplastics etc.).	TCE	2	The city has placed limited focus on encouraging the recovery and/or recycling of wastewater and currently only engages with 2 research projects on the matter. A project analysing where and how struvite can be extracted from wastewater (Municipality of Amsterdam, 2020c, p.53) and another project analyzing how phosphate and energy can be extracted from household wastewater via black and grey water separation (Municipality of Amsterdam, 2020c, p. 105).	
	Increasing the efficiency of water provision (reducing water leakages, rainwater, and seawater reuse etc.).	TCE	1	Actions by the city concerning efficient water provision are limited. There is only a focus on researching the most sustainable way of maintaining swimming pool water (Municipality of Amsterdam, 2020c, p.157)	
	Creating incentives to reduce water consumption (e.g., incremental fees, quotas. etc.).	TCE			
	Promoting urban agriculture, including community-supported agriculture,	RCS		The city is taking some action to promote urban agriculture and the consumption of locally grown food. For example, the	Glasgow City Council is promoting urban agriculture and the consumption of locally grown food in two main ways. First,

Food and organic waste streams	allotments and community gardens, and the consumption of locally grown food.		3	municipality is supporting De KasKantfene, an initiative to promote healthy and local food through circular urban agriculture (Municipality of Amsterdam, 2020c, p.35) and is also working alongside external partners to operate a hub for sustainable regional food which will efficiently transport and distribute local produce (Municipality of Amsterdam, 2020c,p.35). Further, alongside Voedsel Verbindt, the municipality has supported the development of an online platform about Amsterdam food initiatives and entrepreneurs (Municipality of Amsterdam, 2020c, p.56). Whilst these actions are great, more robust action could still be taken to facilitate and support urban agriculture beyond pilot projects or small initiatives, for example, providing communities with land and/or resources to develop their urban agriculture practices or develop incentives to encourage the consumption of locally grown food.	3	through developing a city-wide scheme to support local businesses that support and use sustainable, healthy, local carbon and local produce. This will involve reviewing and re-launching a sustainable business scheme, taking guidance from existing systems such as the Glasgow Food Pledge and the Environmental business awards (Glasgow City Council, 2020a p.113). Second, the city council has created the Glasgow Food Growing Strategy, which had to be created legally under the Scottish Community Empowerment Act (2015) (Glasgow City Council, 2020a p.97). The Strategy works to help citizens gain access to community growing opportunities in their area, for example, by providing land for allotments, engaging with housing associations, and the consideration of a 'Let's Grow Together Fund'. In addition to this, the city council mentions various ambitions such as the use of vertical farming (Glasgow City Council, 2020a p.61), providing discretionary rates to consumers of locally grown food (Glasgow City Council, 2020a p.89) and combining indoor aquaculture with hydroponic vegetable production (Glasgow City Council, 2020a p.96). However, no actions are being taken to achieve those later actions.
	Promoting household and community composting and bio-digestion of bio-waste through financial support, infrastructure development etc.	TCS	3	The city is taking action towards encouraging and promoting household composting and bio-digestion. The municipality is providing everyone with a garden a compost bin or a place to compost locally and is supporting initiatives by residents such as worm hotels, leaf baskets, and bread baking (Municipality of Amsterdam, 2020c, p.47). The municipality is also supporting the Tuinen van West living lab project which is testing on a small-scale bio-waste recovery and soil fertilisation amongst other actions, with the aim of keeping residual flows with the area for reuse (e.g., pruning and composting) (Municipality of Amsterdam, 2020c, p.30). While this is a start, more detail could be given for how the municipality is supporting resident initiatives and on what scale.		
	Establishing centralised bio-waste management systems to recover biomass for fertiliser, biofuel etc. (including separate collection).	TCE	5	This city is working well to establish a more centralised bio-waste management system, with around 7 different actions being taken particularly concerning the collection and use of household bio-waste. For example, they are working on and investigating how to optimise the separation of kitchen and garden waste through the deployment of collection containers, mini containers and sink grinders across the city (Municipality of Amsterdam, 2020c, p.47) and are supporting organic waste stream projects such as turning the fat from deep fryers into cosmetics and turning waste into aromatics (Municipality of Amsterdam, 2020c, p.53). There are also various research projects under way concerning phosphate extraction from urine (IP, p.31) and how biomass can be used efficiently in the metropolitan area (Municipality of Amsterdam, 2020c, p.49).		
	Encouraging the transition towards more sustainable diets and reducing food waste, for example, through waste prevention campaigns and regulations restricting food disposal.	RCS	3	The city is working to encourage the transition towards more sustainable diets and reducing food waste in a number of ways. At the moment, the actions taken are predominantly pilot or research projects. For example, the municipality is working with Rabobank to combat food waste on one street in Amsterdam with the hope of later upscaling (Municipality of Amsterdam, 2020c, p.41), and a research project monitoring the inflow, consumption,		The city council is working to encourage the transition towards more sustainable diets and reducing food waste in various ways. As mentioned, the council is developing a city-wide scheme to support local businesses that support and use sustainable, healthy, local carbon and local produce. This will involve reviewing and re-launching a sustainable business scheme, taking guidance from existing systems such as the

				and disposal of protein products (Municipality of Amsterdam, 2020c,p.38). However, there a few projects which are actively working to reduce food waste and change diets, such as an initiative with BuurtBuik which picks up waste food from catering and supermarkets and shares with local residents (Municipality of Amsterdam, 2020c, p. 42) and the Amsterdam Healthy Weight Programme which is working to nudge communities towards more plant-based diets (Municipality of Amsterdam, 2020c, p.39). The municipality could do well to move beyond pilot projects and research programmes to greater incentivise a reduction in food waste and the transition towards more plant-based diets by, for example, by changing school food policies or developing regulations to restrict food waste disposal.	3	Glasgow Food Pledge and the Environmental business awards (Glasgow City Council, 2020a p.113). With the Glasgow Food Pledge, for example, local businesses are encouraged to reduce portion sizes, offer healthier and more plant-based options in promotions, change to healthier cooking oils, etc. (Glasgow City Council, 2020a p.89). However, the council could further incentivise or force local businesses in Glasgow to achieve these goals via financial means or policies. The routemap also mentions the councils support for the Glasgow Food Policy Partnership and emphasises how it aligns with the council's circularity goals (Glasgow City Council, 2020a p.89). The plan includes long term ambitions such as improving access to healthy food, increasing understanding regarding nutrition and sustainability, reducing food waste, and improving the redistribution of surplus food. However, this is not one of the critical actions of the city council in the transition towards CE.	
Transport and mobility	Improving and encouraging shared mobility, such as carpooling, bike-sharing, and car-sharing.	RCS	1	Mentions in the CE strategy the action of renting and sharing cars as an example of refuse, rethink and reduce. However, it is not mentioned as an actual policy or ambition within the CE strategy or the implementation plan (Municipality of Amsterdam, 2020a, p.11)	4	Before the publication of the CE routemap, Glasgow City Council was a strong proponent of shared methods of transport, such as bike-sharing and carpooling. They introduced 500 hire bikes and e-bikes (Next bike) across the city and promoted the use of Co-Wheels, an electric car share scheme, by providing the company with designated parking bays (Glasgow City Council, 2020a p.36). In the next stage, as part of the CE routemap, the council hope to expand their car-sharing and bike hire schemes, potentially introducing the option of e-scooters (Glasgow City Council, 2020a p.88).	
	Building, improving, and encouraging the use of multi-modal public transport infrastructure (bus, train, tram, metro, BRT, water taxi etc.).	RCS	2	The city expresses concern about building, improving, and encouraging the use of multi-modal public transport infrastructure through only one project. This project focuses on extending the north-south light rail line to Schiphol and Hoofddorp and closing of its small ring in a climate neutral and resistant manner (Municipality of Amsterdam, 2020c, p.100).	2	Glasgow City Council is taking some action to improve and encourage the use of multi-modal transport. For example, the council supports the Glasgow Metro Initiative, a plan ran by Transport Scotland to improve connectivity between Glasgow and the surrounding local areas, focussing on poorly reached areas and increasing access to amenities and services (Glasgow City Council, 2020a).The city also expresses the desire to create a public transport system free of charge by engaging with interested local stakeholders and authorities, based on recommendations from the Climate Emergency Report (Glasgow City Council, 2020a p.19). Nevertheless, the city council does not note how they support the Glasgow Metro Initiative, and the transition to free public transport is still in its early stages.	
	Promoting active transport by improving cycling infrastructure, creating pedestrianised areas, and disincentivising motorised transport (e.g., reduced speed zones, speed bumps, traffic lights etc.).	RCS				2	Glasgow is, to a certain extent, committed to promoting active transport. The council hopes to keep sustainable transport solutions and infrastructure constructed during the covid-19 pandemic, such as wider pavements and 'strategic' cycle lanes, in place permanently (Glasgow City Council, 2020). The council will conduct an evaluation and create an online survey to identify the thoughts and opinions of the public to see whether the measures has been successful thus far (Glasgow City Council, 2020a p.88). However, beyond the project, action in this policy area is limited.
	Promoting the use of green technologies such as electric cars and autonomous (self-	TCE					

	driving) public and semi-private transportation systems (taxis, delivery cars, drones etc.).					
Green Buildings	Setting circular design, construction and material use standards, and regulations to obtain construction permits (energy and water efficiency, use of recovered materials, design for durability, modular design, adaptive construction, design for disassembly, vernacular architecture etc.).	TCE	4	The city is taking over 12 actions towards setting circular design, construction and material use standards and regulations. Most notably, the municipality is tightening the environmental performance standards of buildings by looking at what would be technically feasible standards for buildings and then, if acceptable, will be the standard for the entire city (Municipality of Amsterdam, 2020c, p.91). Furthermore, the municipality is working with developers and other municipal parties to create a circular area development plan which will set minimum sustainability requirements for the city and include other ambitions such as circular disassembly and building flexibly (Municipality of Amsterdam, 2020c, p.97). However, despite the commitment to creating circular standards and regulations, there is no information concerning whether these standards and regulations will be legally binding and enforced strictly.	2	To a certain extent, Glasgow is committed to setting circular design, construction, and materials use standards and regulations. The city council believes that through planning policy and conditions, they can normalise modular construction, design for disassembly and other circular design practices (Glasgow City Council, 2020a p.81). However, the city council has not laid out steps to achieve this ambition thus far beyond their participation in the EU CIRCuIT project. The CIRCuIT project aims to scale up the adoption of circular construction techniques through demonstration, knowledge, and skill-sharing activities though rather than setting standards or regulations (Glasgow City Council, 2020a p.81).
	Fostering circular recovery of demolition materials (R7) through measures such as strong environmental standards for the handling of demolition waste.	TCE	2	The city is only doing 2 research programmes to foster the circular recovery of demolition waste. The first investigates the role of the municipality in stimulating the recycling of construction and demolition waste (Municipality of Amsterdam, 2020c, p.142) the second seeks to gain insight into the supply and demand structure of new and previously used building materials (Municipality of Amsterdam, 2020c, p.142). However, as these are both research programmes rather than concrete actions, commitment to this policy area could be stronger.	1	The city council mentions developing policies that will instruct contractors to collect waste materials and bring them to a storage facility for reuse (Glasgow City Council, 2020a p.82). However, this is only an ambition, and no further action is taken in this area.
	Facilitating infrastructure refurbishment, renovation and retrofitting through financial incentives and subsidies to improve energy efficiency and reduce energy bills.	RCS	1	The municipality states that by 2025, 50% of all renovations and building maintenance activities in Amsterdam will follow the principles of circular construction as a way of reducing energy bills for low-income households (Municipality of Amsterdam, 2020a, p.78). However, it is unclear how they will meet this target. Action in this area is limited to a single research project according to the implementation plan, which is researching how buildings can be maintained and insulated in a climate neutral and circular manner (Municipality of Amsterdam, 2020c, p.130).	1	The city council mentions the use of capital projects to create more energy-efficient housing and cleaner energy systems, with the aim of improving citizens quality of life (Glasgow City Council, 2020a p.98). However, this is only ambition, and no action is being taken thus far in this area.
	Repurposing or renovating old/disused buildings to ensure more efficient use of current building stock, improve energy efficiency, create economic opportunities, and prevent unnecessary demolition/construction.	TCE	3	The city focussing somewhat on repurposing or renovating old/disused buildings and infrastructure in order to improve energy and material efficiency and create economic opportunities, with around 7 different actions being taken. For example, they are working to renovate building facades, urban shipyards, and quay walls according to circular principles (Municipality of Amsterdam, 2020c, p. 130, 135 113, 123) and are, also, researching how new or old housing can be renovated in a circular manner and what the CO2 footprints would be in order to tighten the MilieuPrestatie Gebouwen (building environmental performance) (Municipality of Amsterdam, 2020c, p.140, 129). However, more significant action could be taken in this policy area beyond pilot projects and research programmes.	3	The city council is committed to repurposing old/disused buildings to improve energy efficiency and the efficient use of building stock. Through the Local Heat and Energy Efficiency strategy (LHEES), the city council is encouraging and exploring circular and sustainable construction opportunities, specifically the retrofitting of buildings (Glasgow City Council, 2020a p.81, 115). However, whilst LHEES is run by the city council, it is mostly funded by the Scottish Government and is part of the broader Energy Efficient Scotland programme. In addition, within its circular construction statement, the council is considering the possibility of making retrofit the standard construction method in Glasgow for all building projects and banning demolition (Glasgow City Council, 2020a p.107).
	Redistribution and repurposing of old/disused building for social and community purposes to ensure a fairer and	TCS				

	more sustainable use of current building stock.				
	Promoting efficient, sustainable, and fair use of current building stock by promoting shared uses such as shared workspaces and co-housing (shared space/facilities such as utility rooms, communal areas, play areas, guestrooms etc.).	RCS			3 The city council mentions taking advantage of vacant units to create incubator co-working facilities for circular businesses (Glasgow City Council, 2020a p.64) and will identify the relevant units through a baseline audit of council property. However, the Glasgow City Council could go further to create co-working and shared facilities for non-circular businesses and promote co-housing, for example.
	Reduce per-capita consumption and accumulation of private building stock (e.g., by establishing limits on new housing size (for example, 44m2 per capita or less), banning new single-family housing or banning the ownership of second homes).	TCS			
Urban form and territorial planning	Facilitating the creation of exclusive urban territories such as gated communities, shelter-in-place infrastructure, and private bunkers to protect from disasters and conflicts.	FCE			
	Encouraging and facilitating neighbourhood development/design centred around public transport nodes and high-density multi-functional spaces (combining housing with shops, services, and public infrastructure) to improve social cohesion and reduce urban environmental footprint (through land use and zoning laws, 20-minute neighbourhood policies, urban re-development projects etc.).	RCS			2 The city council is working to create a 20-minute city through its Liveable Neighbourhoods Programme (Glasgow City Council, 2020a p.29). They are currently in the first stages of the programme and have published a toolkit that can allow communities to assess the quality of their neighbourhoods and define common issues, which can then be targeted by policies and innovations (Glasgow City Council, 2020a p. 99) Beyond this toolkit though, little tangible action is taking place on the part of the city council. Furthermore, the movement towards a 20-minute city reflects a nationwide move towards this goal, so it is unknown whether, without support at higher levels of Government, the city would have pursued this line of action themselves.
	Building infrastructure for climate resilience and adaptation (seawalls, levies, dams etc.), including ecosystem-based climate change adaptation and disaster risk reduction (green flood plains, slope greening to reduce landslides, etc.).	TCE			
	Fostering urban-rural symbiosis and supporting rural livelihoods (e.g., using waste from urban areas to fertilise soils while providing local food to city inhabitants through farmer's markets etc.).	TCS	2	The city is taking a few small actions towards fostering urban-rural symbiosis and rural. The main action pertaining to the policy area is municipalities involvement in the EU's RUMORE project, which aims to rural-urban partnerships and coordination (Municipality of Amsterdam, 2020c, p.28). Here, the EU has given the municipality financial resource to stimulate cooperation between entrepreneurs and knowledge institutes in the metropolitan area. The result of the RUMORE project is 5 small research projects and/or activities, thus, at the moment, wider transformation is not being fostered.	
	Providing ecosystem services by restoring local biodiversity and creating green	RCS		The city only focusses on providing ecosystem services and improving biodiversity through one small pilot project. This	The city council provides ecosystem services by opening up unused vacant and derelict land, green areas, and

Ecosystems and nature-based solutions	infrastructure (greening roads and public infrastructure, building parks, transforming parking lots into gardens, creating green roofs and walls etc.).		1	initiative is a Food Forest in southeast Amsterdam which aims to increase biodiversity of the area and make it more climate resilient, alongside stimulating social cohesion within the community. As such, this policy area is not a priority for the municipality (Municipality of Amsterdam, 2020c, p.30)	3	community growing spaces (Glasgow City Council, 2020a p.117). The appropriate locations will be identified by carrying out a land audit. However, it is unclear how much land will be dedicated to green spaces.
	Conserving and protecting biodiversity to increase harmony between social and natural ecosystems (e.g., by capping land artificialisation and the occupation of natural areas, establishing strict protection of green corridors and belts, creating conservation areas, banning mining activities etc.).	TCS				
	Establishing payments for ecosystem services (e.g., water conservation through water bill, air quality through congestion charges, etc.).	TCE				

Appendix 3

Policy Area	Policies	Source	Discourse type	Reasoning
Economic and industrial policy	Funding and supporting CE initiatives, entrepreneurs, and start-ups (project grants, subsidies and low-interest loans, tax breaks, enterprise zones, pilot projects, business platforms etc.).	(Belaud et al., 2019; Carrière et al., 2020; Cuomo et al., 2020; Jiao et al., 2019; Kębłowski et al., 2020; Monaghan et al., 2016; Prendeville et al., 2018; Russell et al., 2020; Savini, 2019; Schweickart, 2009; Xue, 2021; Yu et al., 2015; Zhao, 2020)	TCE	Focuses on fostering the transition through private sector innovation and economic competitiveness.
	Deregulating and liberalising to support innovation and foreign investment in new CE initiatives and businesses.	(Cuomo et al., 2020; Fu, 2016; Höffken & Limmer, 2019; Monaghan et al., 2016)	TCE	Focuses on opening markets to facilitate innovations, eco-efficiency, and economic competitiveness.
	Promoting the local production of goods, shopping at local small businesses and the use of cooperative production structures.	(Benyus, 2015; Crabtree, 2006; Fratini et al., 2019; Korsunsky, 2019; Latouche, 2016; Petit-Boix & Leipold, 2018; Poland et al., 2019; Savini, 2021; Shebell & Moser, 2019; White, 2008)	TCS	Focuses on social justice, worker empowerment and ecosystem harmony by democratically transforming and redistributing production structures.
	Encouraging and creating the capacity for deindustrialisation and local autonomy (traditional labour-intensive production of basic needs such as food, tools, clothing, energy, and housing).	(Latouche, 2016; Nicolosi & Feola, 2016; Savini, 2021)	TCS	Focuses on transformative education and empowerment for radical autonomy and conviviality.
	Improving eco and material efficiency by promoting and encouraging the use of high-tech communication technologies (smart meters, fibre optics, AI/machine learning, 3D printing, smart LED lighting, automation etc.)	(Adapa, 2018; Carrière et al., 2020; Cuomo et al., 2020; A. C. de Ferreira & Fuso-Nerini, 2019; Fratini et al., 2019; Fu, 2016; Höffken & Limmer, 2019; Petit-Boix & Leipold, 2018; Prendeville et al., 2018; Russell et al., 2020; Savini, 2019; Shah et al., 2020; White, 2008)	TCE	Focuses on high-tech innovations for eco-efficiency and economic competitiveness.
	Shifting public services to the private sector (housing, water provision, energy etc.) to improve cost-efficiency.	(Fu, 2016)	FCE	Focuses solely on eco-efficiency and economic competitiveness without regard for social and environmental justice.
	Expropriating, dispossessing, and displacing poor communities for economic development (gentrification) or for building infrastructure for disaster risk reduction.	(Mcbride, 2016)	FCE	Focuses solely on eco-efficiency and economic competitiveness without regard for social and environmental justice.
	Establishing and facilitating participatory mechanisms for the development, governance, and implementation of CE-policies (such as participatory budgeting, referendums, and citizen councils).	(Baffour Awuah & Booth, 2014; Crabtree, 2006; Hidayat & Stoecker, 2018; Kębłowski et al., 2020; Korsunsky, 2019; Kusumo, 2011; Latouche, 2016; Poland et al., 2019; Prendeville et al., 2018; Savini, 2021; Thomson & Newman, 2018; Voytenko Palgan et al., 2021b; Xue, 2021; Zhao, 2020)	RCS	Seeks a fair and democratic governance of the city and its resources in order to ensure social, environmental, and economic sustainability.
	Establishing and/or facilitating collaborative governance mechanisms with industrial and other actors to improve eco-efficiency (such as Public-Private Partnerships, multi-stakeholder partnerships and extended producer responsibility organisations).	(Baffour Awuah & Booth, 2014; Bolger & Doyon, 2019; Campbell-Johnston et al., 2019; Kębłowski et al., 2020; Liu et al., 2018; Prendeville et al., 2018; Yu et al., 2015)	TCE	Focuses on greater collaboration between government and industry to improve the management and governance of material and energy resources. Focuses on greater eco-efficiency but has no social justice element.

Governance and municipal operations	Establishing municipal monitoring and evaluation systems, utilising data and information on key material and energy flows (e.g., pollution discharges, traffic flows, industrial symbiosis exchanges etc.).	(Belaud et al., 2019; Liu et al., 2018; Russell et al., 2020; Spiegelhalter & Arch, 2010; C. Yu et al., 2015; Zhao, 2020).	TCE	Focuses on understanding city resource flows and tracking ecological impacts to improve eco-efficiency with no specific social justice component.
	Creating or improving environmental standards on pollution, emissions, energy, and resource efficiency with effective auditing mechanisms.	(Cerceau et al., 2014; Jiao et al., 2019; Liu et al., 2018; Wu, 2014; C. Yu et al., 2015; F. Yu et al., 2015; Zhao, 2020)	TCE	Focuses on reducing environmental impacts and improving eco-efficiency via regulation that sets standards on "accepted" levels of emissions for economic activities. It seeks to increase environmental sustainability and circularity but has no social justice and participation component.
	Circular management of public goods and infrastructure through public procurement, public tenders, product-service systems and/or building as a service (for office space, lighting, heating/cooling, communications, electronics, carpeting, cleaning, etc.).	(Bolger & Doyon, 2019; Campbell-Johnston et al., 2019; Carrière et al., 2020; Cuomo et al., 2020; Di Biccari et al., 2016; Joensuu et al., 2020; Petit-Boix & Leipold, 2018; Prendeville et al., 2018; Zhao, 2020)	RCS	Focuses on improving sustainable use of state budget so that government purchases lead to greatest social and environmental benefits.
Education and knowledge development	Establishing and/or supporting communication initiatives for awareness-raising and behavioural change that improve material and resource efficiency (e.g., launching media campaigns or education programmes to improve household sorting of waste).	(Belaud et al., 2019; Bolger & Doyon, 2019; Christis et al., 2019; A. C. de Ferreira & Fuso-Nerini, 2019; Dushkova & Haase, 2020; Fratini et al., 2019; Gravagnuolo et al., 2019; Joensuu et al., 2020; Lehmann, 2011; Liu et al., 2018; Marin & de Meulder, 2018; McIntyre-Mills, 2020; Prendeville et al., 2018; Russell et al., 2020; Savini, 2019)	TCE	Seeks to influence citizens behaviour to improve material and energy efficiency without a social justice component.
	Fostering cultural transformation towards holistic ecological and social worldviews through community-owned media sources, restrictions on advertisements, promotion of non-materialist values and community ethics etc.	(Carrière et al., 2020; A. C. de Ferreira & Fuso-Nerini, 2019; Fratini et al., 2019; Haluza-DeLay & Berezan, 2013; Hidayat & Stoecker, 2018; Joensuu et al., 2020; Poland et al., 2019; Prendeville et al., 2018; White, 2008)	TCS	Focuses on influencing citizens worldview, behaviour and consumption habits in a sustainable manner leading to social and environmental transformation.
	Establishing and/or supporting training, capacity building and education initiatives to spread the technical skills and knowledge needed for a circularity transition	(Carrière et al., 2020; A. C. de Ferreira & Fuso-Nerini, 2019; Fratini et al., 2019; Joensuu et al., 2020; McIntyre-Mills, 2020; Prada-Trigo, 2016; Prendeville et al., 2018; Russell et al., 2020)	RCS	Seeks to enhance the knowledge and skills necessary for the transition to a circular economy and society.
	Establishing or supporting CE research, innovation and knowledge development through collaboration platforms, knowledge hubs, research projects ('urban living labs', 'fab labs', 'Smart citizen labs' etc.).	(Albrecht & Kortelainen, 2021; Campbell-Johnston et al., 2019; Carrière et al., 2020; Cuomo et al., 2020; A. C. de Ferreira & Fuso-Nerini, 2019; Fu, 2016; Gravagnuolo et al., 2019; Jiao et al., 2019; Lehmann, 2013; Liu et al., 2018; Marin & de Meulder, 2018; Prada-Trigo, 2016; Prendeville et al., 2018; Russell et al., 2020; Zhao, 2020)	RCS	Seeks to co-create knowledge and innovations to foster a circular economy and sustainability transition.
Fostering inclusivity and social justice by guaranteeing equal access to urban infrastructure and services (e.g., welcoming refugees, building accessible infrastructure, and securing access to quality education, healthcare, recreational facilities, cultural and artistic activities etc.).	(Baffour Awuah & Booth, 2014; Beebeeejaun, 2017; Carrière et al., 2020; Crabtree, 2006; Cuomo et al., 2020; A. C. de Ferreira & Fuso-Nerini, 2019; Deng et al., 2012; Dushkova & Haase, 2020; Savini, 2021; Shebell & Moser, 2019; Theomai et al., 2015; Younés, 2014).	TCS	Focuses on social empowerment and emancipation through equal access to urban infrastructure and services.	

Social justice and livelihoods	Promoting and building community housing, social housing, housing cooperatives and community land trusts.	(Crabtree, 2006; Cuomo et al., 2020; A. Ferreira & von Schönfeld, 2020; Korsunsky, 2019; Marin & de Meulder, 2018; North & Longhurst, 2013; Poland et al., 2019; Savini, 2021; Shebell & Moser, 2019; Theomai et al., 2015; Thomson & Newman, 2018; White, 2008)	TCS	Focuses on the distribution of wealth and housing stock to ensure social justice and equity.
	Encouraging and supporting the creation of local currencies and cooperative banking to support CE-related activities.	(Du Plessis, 2012; North & Longhurst, 2013; Poland et al., 2019; Taylor, 2012)	TCS	Seeks a fair and just circulation of money, power, and wealth.
	Promoting sharing economy activities (repair cafés, fab labs, swap shops, second-hand shops, zero-waste café etc.) by providing resources, infrastructure, and digital platforms.	(Bolger & Doyon, 2019; Campbell-Johnston et al., 2019; Cohen & Muñoz, 2016; Crabtree, 2006; Economy et al., 2017; Fratini et al., 2019; Joensuu et al., 2020; Kęłowski et al., 2020; Korsunsky, 2019; Markendahl et al., 2018; Nicolosi & Feola, 2016; Petit-Boix & Leipold, 2018; Poland et al., 2019; Prendeville et al., 2018; Savini, 2019; Theomai et al., 2015; Voytenko Palgan et al., 2021; White, 2008)	RCS	Focuses on the solidarity, sharing and community-building components of CE.
Renewable energy	Establishing and/or supporting centralised renewable energy production infrastructure (rooftop solar, wind, geothermal etc.).	(Baffour Awuah & Booth, 2014; Carrière et al., 2020; Cerceau et al., 2014; Cuomo et al., 2020; A. C. de Ferreira & Fuso-Nerini, 2019; Lehmann, 2013; Petit-Boix & Leipold, 2018; Prendeville et al., 2018; Russell et al., 2020; Spiegelhalter & Arch, 2010; Thomson & Newman, 2016, 2018; Yu et al., 2015)	TCE	Fosters the transition towards CE through top-down technical innovation.
	Promoting decentralised community-owned renewable energy production.	(Benyus, 2015; Cohen & Muñoz, 2016; Crabtree, 2006; Cuomo et al., 2020; Di Biccari et al., 2016; Korsunsky, 2019; Kusumo, 2011; Markendahl et al., 2018; North & Longhurst, 2013; Savini, 2021; Spiegelhalter & Arch, 2010; Theomai et al., 2015; White, 2008; Xue, 2021)	RCS	Seeks to redistribute ownership and change power structures related to energy production.
Waste management	Improving waste separation, collection, processing and recycling infrastructure and processes.	(Bolger & Doyon, 2019; Cuomo et al., 2020; Kęłowski et al., 2020; Petit-Boix & Leipold, 2018; Prendeville et al., 2018; Spiegelhalter & Arch, 2010; Theomai et al., 2015)	TCE	Focuses on CE transition through waste management technologies and innovations. It seeks to increase environmental sustainability and circularity but has no social justice and participation component.
	Fostering the creation of an efficient secondary materials market through material passports and banks, digital technologies and storage and logistics infrastructure.	(Campbell-Johnston et al., 2019; A. C. de Ferreira & Fuso-Nerini, 2019; Gravagnuolo et al., 2019; Joensuu et al., 2020)	TCE	Focuses on improving eco and material efficiency with no specific social justice and participation component.
	Establishing incentives to reduce grey (non-recyclable) waste (taxations, pay as you throw structures etc.).	(Campbell-Johnston et al., 2019; Carrière et al., 2020; Fratini et al., 2019; Joensuu et al., 2020; Spiegelhalter & Arch, 2010; Yu et al., 2015)	TCE	Utilises economic incentives for better waste sorting and eco-efficiency. It seeks to increase environmental sustainability and circularity but has no social justice and participation component.
	Developing and implementing urban mining activities (material and energy recovery from landfills).	(Taylor Buck & While, 2020; Zhao, 2020)	TCE	Utilises high-tech innovations to improve resource recovery and material efficiency. It seeks to increase environmental sustainability and circularity but has no social justice and participation component.
	Banning certain single-use packaging (e.g., shopping bags, takeaway containers, coffee mugs, etc.) and encouraging bulk shopping and reusable containers.	(Carrière et al., 2020; Petit-Boix & Leipold, 2018; Spiegelhalter & Arch, 2010)	TCS	Focuses on radical changes in behaviour and consumption habits to reduce overall material consumption.

	Restricting certain single-use packaging (e.g., shopping bags, takeaway containers, coffee mugs, etc.) or replacing them with bio-based and/or compostable ones.	(Carrière et al., 2020; Petit-Boix & Leipold, 2018)	TCE	Seeks incremental changes to replace problematic single-use packaging materials and replace them for better ones. Has no social justice and participation element.
	Promoting industrial and urban symbiosis and eco-industrial parks for material, nutrient and energy cycling and recovery (e.g., utilisation of excess industrial heat to heat nearby urban areas, waste outputs as industrial inputs etc.).	(Adapa, 2018; Albrecht & Kortelainen, 2021; Baffour Awuah & Booth, 2014; Carrière et al., 2020; Cerceau et al., 2014; A. C. de Ferreira & Fuso-Nerini, 2019; Dunn & Steinemann, 1998; Gravagnuolo et al., 2019; Joensuu et al., 2020; Korhonen, 2002; Liu et al., 2018; Petit-Boix & Leipold, 2018; Shah et al., 2020; Taylor Buck & While, 2020; Thomson & Newman, 2018; Yu et al., 2015; Zhao, 2020)	TCE	Focuses on resource-efficiency through industrial innovation and technology to build win-win solutions.
Water management	Encouraging the recovery/recycling of wastewater (as fertiliser, energy, bioplastics etc.).	(Carrière et al., 2020; Cerceau et al., 2014; Crabtree, 2006; Cuomo et al., 2020; A. C. de Ferreira & Fuso-Nerini, 2019; Gravagnuolo et al., 2019; Joensuu et al., 2020; Kusumo, 2011; Liu et al., 2018; Marin & De Meulder, 2018; Savini, 2021; Shah et al., 2020; Spiegelhalter & Arch, 2010; Taylor Buck & While, 2020; Theomai et al., 2015; Thomson & Newman, 2016)	TCE	Seeks economic efficiency and environmental gains through technical means. Has no social justice and participation element
	Increasing the efficiency of water provision (reducing water leakages, rainwater, and seawater reuse etc.).	(Benyus, 2015; Crabtree, 2006; A. C. de Ferreira & Fuso-Nerini, 2019; Gravagnuolo et al., 2019; Joensuu et al., 2020; Liu et al., 2018; Marin & De Meulder, 2018; Petit-Boix & Leipold, 2018; Shah et al., 2020).	TCE	Seeks economic efficiency and environmental gains through technical means. Has no social justice and participation element
	Creating incentives to reduce water consumption (e.g., incremental fees, quotas etc.).	(Fratini et al., 2019; Petit-Boix & Leipold, 2018; Yu et al., 2015)	TCE	Seeks an efficient reduction of overall water use without a social justice and participating component.
Food and organic waste streams	Promoting urban agriculture, including community-supported agriculture, allotments and community gardens, and the consumption of locally grown food.	(Benyus, 2015; Carrière et al., 2020; Cohen & Muñoz, 2016; Crabtree, 2006; Cuomo et al., 2020; Dushkova & Haase, 2020; A. Ferreira & von Schönfeld, 2020; Fratini et al., 2019; Haluza-Delay & Berezan, 2013; Joensuu et al., 2020; Kębłowski et al., 2020; Korsunsky, 2019; Kusumo, 2011; Leipold et al., 2019; Marin & De Meulder, 2018; North & Longhurst, 2013; Petit-Boix & Leipold, 2018; Poland et al., 2019; Savini, 2021; Schneider et al., 2019; Taylor Buck & While, 2020; Taylor, 2012; Thomson & Newman, 2018; White, 2008; Xue, 2021; Zhao, 2020)	RCS	Seeks various social and ecological benefits from urban agriculture (food production, urban greening, community-building).
	Promoting household and community composting and bio-digestion of bio-waste through financial support, infrastructure development etc.	(Cuomo et al., 2020; A. C. de Ferreira & Fuso-Nerini, 2019; Fratini et al., 2019; Lehmann, 2011; Savini, 2019; Spiegelhalter & Arch, 2010)	TCS	Fosters a local and community-based approach to bio-waste recovery with various social and environmental benefits, as it replenishes the natural cycles of the earth in a communal manner.
	Establishing centralised bio-waste management systems to recover biomass for fertiliser, biofuel etc. (including separate collection).	(Albrecht & Kortelainen, 2021; Bolger & Doyon, 2019; Cuomo et al., 2020; Dunn & Steinemann, 1998; Fratini et al., 2019; Joensuu et al., 2020; Lehmann, 2011; Liu et al., 2018; Obersteg et al., 2019; Savini, 2019; Taylor Buck & While, 2020; Thomson & Newman, 2016, 2018; Zhao, 2020)	TCE	Establishes organic waste management structures based on technical efficiency. Has no social justice and participation element.

	Encouraging the transition towards more sustainable diets and reducing food waste, for example, through waste prevention campaigns and regulations restricting food disposal.	(Carrière et al., 2020; Christis et al., 2019; Kębłowski et al., 2020; Savini, 2019)	RCS	Seeks to reduce inefficient resource use through education, behavioral change, and regulation rather than technology.
Transport and mobility	Improving and encouraging shared mobility, such as carpooling, bike-sharing, and car-sharing.	(Carrière et al., 2020; Christis et al., 2019; Cohen & Muñoz, 2016; A. C. de Ferreira & Fuso-Nerini, 2019; Di Biccari et al., 2016; Kębłowski et al., 2020; Lehtinen, 2018; Markendahl et al., 2018; Petit-Boix & Leipold, 2018; Voytenko Palgan et al., 2021; White, 2008)	RCS	Seeks to change behaviours by encouraging sharing and re-use to obtain key societal, economic, and environmental benefits.
	Building, improving, and encouraging the use of multi-modal public transport infrastructure (bus, train, tram, metro, BRT, water taxi etc.).	(Crabtree, 2006; Spiegelhalter & Arch, 2010; North & Longhurst, 2013; Baffour Awuah & Booth, 2014; Ramos, 2015; Petit-Boix & Leipold, 2018; Prendeville et al., 2018; De Ferreira & Fuso-Nerini., 2019; Christis et al., 2019 Shebell & Moser, 2019; Kębłowski et al., 2020)	RCS	Seeks to change behaviours by encouraging the use of public transport to obtain societal, economic, and environmental benefits.
	Promoting active transport by improving cycling infrastructure, creating pedestrianised areas, and disincentivising motorised transport (e.g., reduced speed zones, speed bumps, traffic lights etc.).	(Crabtree, 2006; Spiegelhalter & Arch, 2010; Taylor 2012; Du Plessis, 2012; North & Longhurst, 2013 Ramos, 2015; Beebeejaun, 2017; Petit-boix & Leipold, 2018; Xue, 2020; Thomson & Newman, 2020; Russell et al., 2020; Savini, 2021.)	RCS	Seeks to change behaviours by encouraging the use of active transport to obtain societal, economic, and environmental benefits.
	Promoting the use of green technologies such as electric cars and autonomous (self-driving) public and semi-private transportation systems (taxis, delivery cars, drones etc.).	(Baffour Awuah & Booth, 2014; Petit-Boix & Leipold 2018; Prendeville et al., 2018; Marin & Meulder, 2018)	TCE	Utilises high-tech innovations in the transport sector to improve eco-efficiency. It seeks to increase environmental sustainability and circularity but has no social justice and participation component.
Green Buildings	Setting circular design, construction and material use standards, and regulations to obtain construction permits (energy and water efficiency, use of recovered materials, design for durability, modular design, adaptive construction, design for disassembly, vernacular architecture etc.).	(Crabtree, 2006; Spiegelhalter & Arch, 2010; Sun et al., 2011; Lehmann, 2012; Lehmann, 2012; North & Longhurst, 2013; Wu, 2014; Baffour Awuah & Booth, 2014; Yu et al. 2015; Campbell-Johnston et al., 2019; Fratini et al.,2019; Gravangnulo et al., 2019; Petit-Boix & Leipold 2018; Joensuu et al., 2020; Hidayat & Stoecker 2018; Marin & Meulder, 2018; Christis et al., 2019; Höffken & Limmer, 2019; Thomson & Newman, 2020; Thomson & Newman 2020a; Buck & While, 2020; Dushkova & Hasse, 2020)	TCE	Focuses on technical knowledge and methods for increased material and energy efficient buildings. It seeks to increase environmental sustainability and circularity but has not social justice and participation.
	Fostering circular recovery of demolition materials (R7) through measures such as strong environmental standards for the handling of demolition waste.	(Lehmann, 2012; Campbell-Johnston et al., 2019; Joensuu et al., 2020)	TCE	Focuses on the utilisation of technical knowledge to improve material-efficiency. It seeks to increase environmental sustainability and circularity but has no social justice and participation component.
	Facilitating infrastructure refurbishment, renovation and retrofitting through financial incentives and subsidies to improve energy efficiency and reduce energy bills.	(Spiegelhalter & Arch, 2010; Yu et al. 2015; Prendeville et al., 2018; De Ferreira & Fuso-Nerini., 2019; Petit-Boix & Leipold 2018; Adapa, 2018; Korsunsky, 2019; Carrière et al., 2020; Dushkova & Hasse, 2020).	RCS	Seeks economic, social, and environmental benefits through improved energy-efficiency in the building sector.
	Repurposing or renovating old/disused buildings to ensure more efficient use of current building stock, improve energy efficiency, create economic opportunities, and prevent unnecessary demolition/construction.	(Lehmann, 2012; Lehtinen, 2018)	TCE	Seeks energy and material efficiency in the building sector without a social justice component.

	Redistribution and repurposing of old/disused building for social and community purposes to ensure a fairer and more sustainable use of current building stock.	(Zárate et al., 2011; Lehmann, 2012; Lehtinen, 2018; Sitas, 2020.)	TCS	Seeks social justice and equity in the use of built environment and a reduction in the need for construction by fairly redistributing current building stock.
	Promoting efficient, sustainable, and fair use of current building stock by promoting shared uses such as shared workspaces and co-housing (shared space/facilities such as utility rooms, communal areas, play areas, guestrooms etc.).	(Crabtree, 2006; Du Plessis, 2012; Cohen & Muñoz, 2016; Salice & Pais, 2017; Markendahl et al., 2019; Palgan et al., 2021; Korsunsky, 2019; Xue, 2020; Cuomo et al., 2020; Savini, 2021.)	RCS	Seeks to change behaviours by encouraging shared use of building space to obtain societal, economic, and environmental benefits.
	Reduce per-capita consumption and accumulation of private building stock (e.g., by establishing limits on new housing size (for example, 44m ² per capita or less), banning new single-family housing or banning the ownership of second homes).	Xue, 2020; Escobar, 2017; Savini, 2021)	TCS	Seeks a radical reduction and redistribution of overall material footprint through policies which have a strong social justice and sufficiency focus.
Urban form and territorial planning	Facilitating the creation of exclusive urban territories such as gated communities, shelter-in-place infrastructure, and private bunkers to protect from disasters and conflicts.	(Myambo & Frassinelli, 2019; Long & Rice, 2020 Ferrer-Gallardo & Albet-Mas 2016.)	FCE	Focuses on protection from socio-ecological crises and events rather than collective solidarity.
	Encouraging and facilitating neighbourhood development/design centred around public transport nodes and high-density multi-functional spaces (combining housing with shops, services, and public infrastructure) to improve social cohesion and reduce urban environmental footprint (through land use and zoning laws, 20-minute neighbourhood policies, urban re-development projects etc.).	(Crabtree, 2006; Spiegelhalter & Arch, 2010; Kusumo, 2011; Du Plessis, 2012; Hong et al. 2014; Baffour Awuah & Booth, 2014; Ramos, 2015; Yu et al. 2015; Petit-boix & Leipold, 2018; Christis et al., 2019; Thomson & Newman 2020; Xue, 2020; Ferreira & von Schönfeld, 2020; Thomson & Newman, 2020a; Savini, 2021.)	RCS	Utilises holistic planning and urban management approaches, which integrate a multitude of social and ecological concerns.
	Building infrastructure for climate resilience and adaptation (seawalls, levies, dams etc.), including ecosystem-based climate change adaptation and disaster risk reduction (green flood plains, slope greening to reduce landslides, etc.).	(Younés, 2014; Fu, 2016; Long & Rice, 2020; Dushkova & Hasse, 2020)	TCE	Focuses on the utilitarian use of knowledge and innovation to increase resilience with no specific social component.
	Fostering urban-rural symbiosis and supporting rural livelihoods (e.g., using waste from urban areas to fertilise soils while providing local food to city inhabitants through farmer's markets etc.).	(Zárate et al., 2011; Hong et al. 2014; Latouche, 2016; Escobar, 2019; Joensuu et al., 2020; Xue, 2020; Spanier & Feola, 2021; Savini, 2021)	TCS	Integrates social equity and fairness in the distribution of resource between urban and rural areas.
Ecosystems and nature-based solutions	Providing ecosystem services by restoring local biodiversity and creating green infrastructure (greening roads and public infrastructure, building parks, transforming parking lots into gardens, creating green roofs and walls etc.).	(Spiegelhalter & Arch, 2010; Zárate et al., 2011; Kusumo, 2011; Sun et al., 2011; Deng et al., 2012; Du Plessis, 2012; Haluza-DeLay & Berezan, 2013; Hong et al., 2014; Baffour Awuah & Booth, 2014; Yu et al. 2015; Ramos, 2015; Benyus, 2015; Prada-Trigo, 2016; Monaghan et al., 2016; Prendeville et al., 2018; Lehtinen, 2018, De Ferreira & Fuso-Nerini, 2019; Korsunsky, 2019; Escobar, 2019; Shebell & Moser, 2019; Petit-boix & Leipold, 2018; Marin & Meulder, 2018; Höffken & Limmer 2019; Poland et al, 2019; Schneider et al, 2019; Thomson & Newman 2020; Thomson & Newman, 2020a; Buck & While, 2020; Dushkova & Hasse, 2020; Bolten & Barbiero, 2020; Russell et al., 2020; Cuomo et al., 2020; Savini, 2021.)	RCS	Uses innovative urban greening approaches to bring about many social and environmental benefits (reduced pollution, less stress, recreational areas, tourism, noise reduction, heat control etc.).
	Conserving and protecting biodiversity to increase harmony between social and natural ecosystems (e.g., by capping land artificialisation and the occupation of natural areas, establishing strict protection of green corridors and belts, creating conservation areas, banning mining activities etc.).	(Spiegelhalter & Arch, 2010; Hong et al. 2014; Petit-boix & Leipold, 2018; Xue, 2020; Thomson & Newman 2020a; Dushkova & Hasse, 2020; Savini, 2021; Spanier and Feola, 2021.)	TCS	Seeks the strict conservation of biodiversity for its intrinsic value beyond utilitarian and anthropocentric considerations.
	Establishing payments for ecosystem services (e.g., water conservation through water bill, air quality through congestion charges, etc.).	(Prada-Trigo, 2016; Suartika & Cuthbert, 2020; Dushkova & Hasse, 2020)	TCE	Seeks to improve ecological conditions via win-win economic mechanisms.

