Governing Circular Development in the Urban Built Environment

An Analysis on Policy Instruments Used in Support of Circular Development in the Urban Built Environment

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Abstract

Circular development in the urban built environment shows high potential in decreasing material consumption and greenhouse gas emissions in a sector that is globally one of the most polluting and resource intensive ones. Several cities and municipalities across Europe, most notably Amsterdam, have begun to adopt a circular approach towards the development of built environment, with environmental and economic incentives as their motivation. This thesis seeks to map out the different policy instruments that cities and municipalities, in particular Amsterdam, use. Thereby, it answers the research question *Which policy instruments, implemented by the municipality of Amsterdam to support the circular development in its built environment, distinguish the municipality's approach from the ones of other cities and municipalities?* Document analysis and systematic literature review are used to select and analyse grey and academic literature. The study finds that the single different instrument that the municipality uses, as compared to the other cases, are research activities. The key to Amsterdam's advancement is the extent to which it uses and combines policy instruments, whereby living labs serve as a good example. Furthermore, it was found that several further factors beyond mere instruments influence the development, such as political ownership, national context, and sufficient municipal funding.

Keywords: circular development, built environment, local governance, policy instruments

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List of Abbreviations

CE	Circular economy
EMF	Ellen MacArthur Foundation
EU	European Union
GLA	The Greater London Authority
GHG	Greenhouse gas
PPP	Public-private partnership
SLR	Systematic literature review
WEF	World Economic Forum

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1. Introduction

By consuming 75% of natural resources, producing 70% of global waste, and 75% of greenhouse gas (hereafter GHG) emissions, cities and urban regions are the centres of consumption, disposal and emission generation (UN Environment Programme [UNEP], 2013). Built environment make up significant amount of these numbers as the construction sector consumes more than three billion tons of raw materials each year (World Economic Forum [WEF], 2016), generates 11% of global energy-related CO_2 emissions, and 40% of urban solid waste (Ellen MacArthur Foundation [EMF], 2019b). Structural waste and the inefficiency of the current linear model of production and consumption is particularly prevalent in the built environment as demonstrated by the numbers: while 10-15% of construction materials are wasted in the building phase, 60% of office buildings in the EU are not used even during working hours (EMF, SUN, & McKinsey Center for Business and Environment, 2015). Moreover, 54% of all demolition waste ends up in landfill (EMF et al., 2015). As the urban population is projected to continuously increase, massive pressure is being created on the already burdened local resource management systems to handle material flows (EMF, 2013).

Since 2014, several, mostly Western European cities and municipalities have taken initiative to support circular economy (hereafter CE) and circular development on the local level (Williams, 2021). Their motivations have been, on the one hand, environmental (e.g., mitigating emissions, producing less waste and easing the pressure on the local management systems), and on the other hand economic (e.g., ensuring resource sufficiency, using resources more efficiently). Some of them – most prominently Amsterdam – are ambitiously working towards shifting the most resource intensive sectors into circular ones. This type of city can be described as a circular city. Because of the novelty of the phenomenon, different conceptualizations exist. Prendeville, Cherim, and Bocken (2018, p.187) define it as one "that practices circular economy principles to close resource loops, in partnership with the city's stakeholders (citizens, community, business and knowledge stakeholders), to realize its vision of a future-proof city". Whereas Ellen MacArthur Foundation (EMF) (2017, p.7) puts forward that "a circular city embeds the principles of a circular economy across all its functions, establishing an urban system that is regenerative, accessible and abundant by design". Circular development, in turn, can be defined as the process which incorporates circular actions into urban supply systems (Williams, 2021). It generates circular systems, activities and infrastructure within the urban environment and can be driven by policies such as spatial planning (Williams, 2021). Circular development closes resource loops at different scales, resulting in a greater sufficiency at the local level (Williams, 2021). Furthermore, it generates adaptable cities, providing space for change, growth, and infrastructure that evolves with changing needs, while protecting and enhancing ecosystem services (Williams, 2021).

At the heart of the implementation of CE on the city level, stand the local government and city managers who are uniquely positioned in realising the development, as they possess extensive knowledge of the

specific urban context and tools for its governance (Erickson & Tempest, 2014). By using their authority and available policy instruments, the authorities can actively engage, encourage, inspire, and oblige stakeholders (EMF, 2019). This is particularly important in the construction sector, which is traditional and conservative in nature, rooted in linear economic practices, and characterized by inertia to change its mode of operation (van Bueren & Priemus, 2002; Gálvez-Martos, Styles, Schoenberger, & Zeschmar-Lahl, 2018; Hart, Adams, Giesekam, Densley Tingley, Pomponi, 2019; Hjaltadóttir & Hild, 2021).

Policy instruments can be defined as "a set of techniques by which governmental authorities wield their power in attempting to ensure support and effect (or prevent) social change" (Vedung, 1998, p.21). The instruments are selected, designed, and implemented with a certain issue in mind, in a specific policy context, and at a certain time, thereby reflecting a specific political-ideological condition of the government (Borrás & Edquist, 2013). The strong contextual nature is central to the design and implementation of the instruments (Borrás & Edquist, 2013).

Despite the key role of policy instrument in initiating circular development in the built environment, only limited amount of literature has been dedicated to identifying these (Çimen, 2021). In response to this knowledge gap, this thesis maps out policy instruments that cities and municipalities across Europe use to enable and support the circular development in the built environment. In so doing, it gives particular attention to the instruments used by the municipality of Amsterdam. Thereby, it aims to identify firstly, the tools that it uses, and secondly, compare these to the ones of other cities and municipalities to pinpoint what distinguishes Amsterdam's approach from the other cities' and municipalities' – if anything. In so doing, the study aims to indicate best practices and a basis for further research on policy instruments in the (Western) European framework. The following empirical, descriptive exploratory question, that constitutes the study's fundament, will be answered:

Which policy instruments, used by the municipality of Amsterdam to support the circular development in the local built environment, distinguish the City's approach from the ones of other cities and municipalities?

Sub-questions are designed to structure the forthcoming empirical analysis, give in-depth insights in the variety of implemented policy instruments and hence to support answering the main research question. The sub-questions 1 and 2 are descriptive in nature, supporting the descriptive analysis of the used instruments. The sub-question 1 is aimed to explore the range of instruments used by different case studies, whereas the sub-question 2 is specifically aimed to study the instruments used by the municipality of Amsterdam. By answering these questions, the thesis prepares a basis for the forthcoming analysis, and hence, answering the sub-question 3, which is rather exploratory in nature. Answering the third sub-question plays a central role in providing an answer to the main research question. The sub-questions are:

1) *What are the central policy instruments that local governments use to support the circular development in the local built environment?*
2) *What are the central policy instruments that the municipality of Amsterdam uses to support the circular development in its local built environment?*
3) *To what extent does the municipality of Amsterdam use the same policy instruments as the other case studies?*

This study shows important social relevance for several reasons. By studying the variety of instruments used to initiate circular development in the urban built environment, this thesis provides insights and best practices for local governments in designing appropriate policies for their own contexts. Thereby, it provides starting points to the further exploration and implementation of CE in an urban context, which, in turn, can create significant social and economic value by saving material and financial resources, while increasing economic returns (Vuță, Vuță, Enciu, & Cioacă, 2018; Busu, 2019; Busu & Lenuta Trica, 2019). Other important positive effects of circular development are the improvement of the quality of the urban environment and its impacts on the living world, for example, by reducing harmful environmental pollution. Due to its labour-intensive nature, CE increases the demand for labour, hence creating employment (Ellen MacArthur Foundation, 2012). Furthermore, the resource inefficiency in the construction sector provides a promising object for applying the CE principles (Paiho, Mäki, Paavola, Tuominen, Antikainen, Heikkilä, Antuña Rozado, & Jung, 2020). Exploring how the development can be effectively initiated is essential due to the novelty of the model. Consequently, it can be argued that the research contributes indirectly to the sustainable development goal 11 on making "cities and human settlements inclusive, safe, resilient and sustainable" (United Nations, n.d.). But also, to several others, such as 9 on industry, innovation and infrastructure, 12 on responsible consumption and production, as well as 13 on climate action, among others (United Nations, n.d.). Moreover, it contributes to the realization of the targets set out by a range of agendas, namely, the United Nations' New Urban Agenda, the European Commissions' the Green New Deal, the European Union Circular Economy Package, United Nations 2030 Agenda for Sustainable Development, Urban Agenda for the EU, and Local Agenda 21 – to name a few of the most important ones.

The amount of scientific literature on governance of CE in an urban context has rapidly increased over the past decade (Reike, Vermeulen, & Witjes, 2018). Similarly, the number of academic studies on CE transformation in the built environment has been on the rise (Çimen, 2021). However, based on a literature review conducted by the author, it was observed that despite the significant role of construction materials in the urban resource flows, a clear gap remains in the literature on policy instruments that are used by local governments to support the initiation of circular development in the built environment. To counteract this, the thesis provides two types of overviews of policy instruments. Firstly, one that maps out the major policy instruments used in mainly (Western) European cities and municipalities based on a literature review. The second one identifies the key instruments used by the municipality of

Amsterdam. This is of particular interest as the city is considered a pioneer in the field. In so doing, the thesis makes a modest, yet important theoretical contribution and provides starting points for further research (see section 6.2 for recommendations).

The thesis is organized in six chapters. After introduction, the study continues with presenting a theoretical framework, encompassing central concepts, on which the following analysis is based on. In the third chapter, the used methodology will be presented together with the coding scheme and case description. Subsequently, the identified instruments of both analyses are contrasted and discussed, followed by a conclusion that answers the research question, briefly analyses the research limitations and presents a research agenda for future.

2. Theoretical framework

This chapter lays out a theoretical basis for the research. It begins by conceptualizing the CE, after which it outlines the concept of circular city. This is followed by an elaboration of the CE in built environment. The chapter concludes by conceptualizing types of policy instrument that are relevant for the following analysis.

2.1 Circular economy in an urban context

2.1.1 Circular economy

The development of the CE concept began as early as 1989 when Pearce and Turner first investigated the linear and open-ended features of modern economic systems. They were inspired by Boulding (1966), who described earth as a closed and circular system with limited absorptive capacity, concluding that environment and economy must coexist in equilibrium. Over the years, different concepts that share the idea of closed loops have come to influence the theory, most importantly: cradle-to-cradle[1] (McDonough & Braungart, 2002), and regenerative design[2] (Lyle, 1994). Thus, the roots of CE locate in industrial ecology, environmental and ecological economics as well as management and corporate sustainability literature (Boulding, 1966; Pearce & Turner, 1989; McDonough & Braungart, 2002).

Today, CE has multiple different conceptualisations. The most renowned is that established by the Ellen MacArthur Foundation[3] (EMF) (Geissdoerfer, Savaget, Bocken, & Hultink, 2017), that defines CE as "an industrial model that decouples revenues from material input" (EMF, 2013, p.7) and that is restorative or regenerative by design. It draws a distinction between the consumption and use of

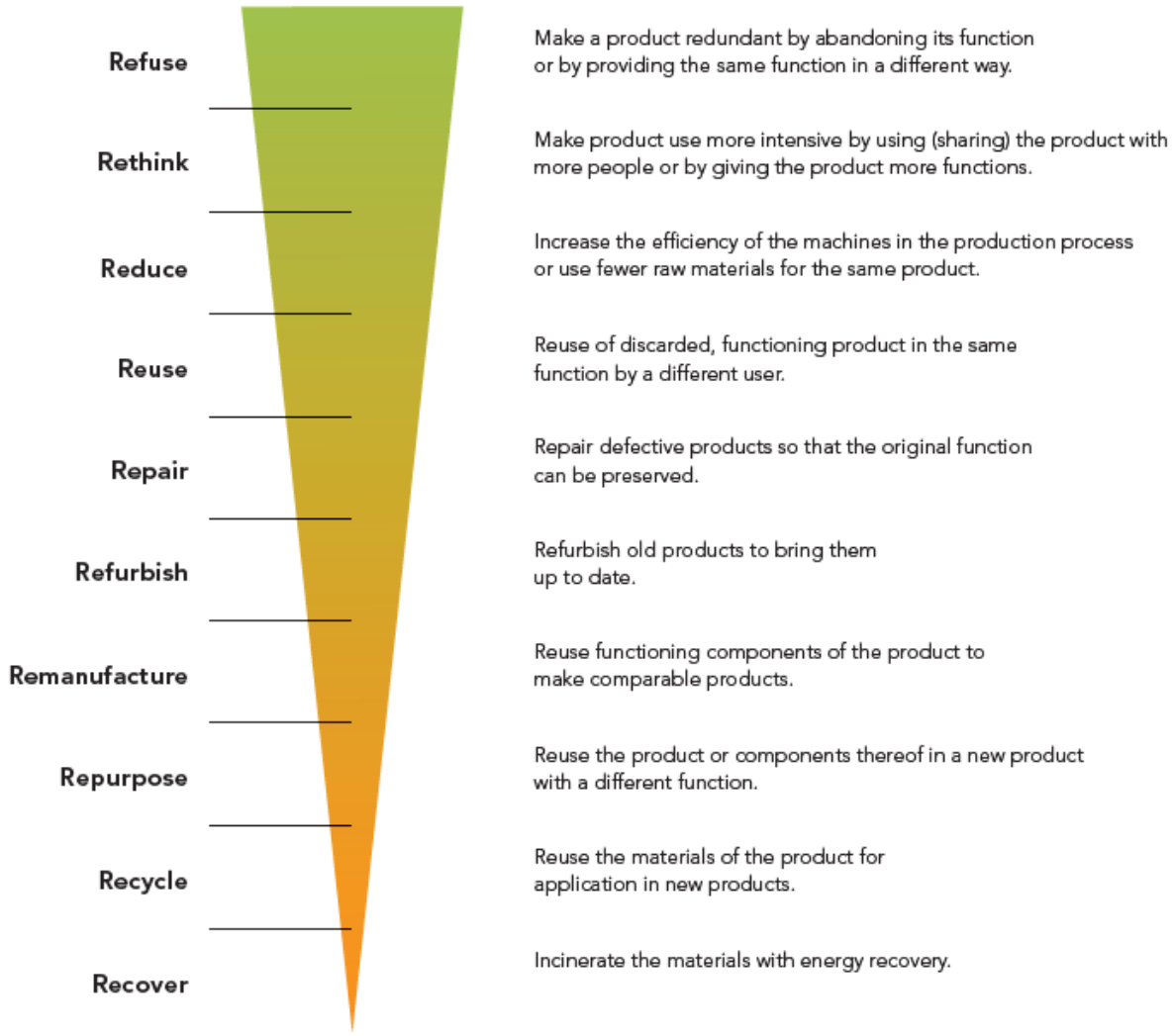
[1] A design theory that focuses on product effectiveness in terms of sustainability and positive impact (EMF, 2013). Thereby, energy, water, and materials involved in industrial and commercial processes are considered as nutrients (EMF, 2013). Therefore, product components should be designed for continuous recovery and reutilisation as biological and technical ingredients within the nutrient metabolism (EMF, 2013).

[2] Design that enables a system to operate in a regenerative manner, meaning that processes renew or regenerate the consumed energy and materials (EMF, 2013).

[3] EMF is a think tank and a not-for-profit organization that promotes CE. They provide solutions and mobilize business, academia, policymakers and institutions locally and globally by working together with these (EMF, n.d.).

materials by advocating for the need of a 'functional service' model in which the ownership of a product remains with the manufacturer or retailer who sell the use of a product instead of product ownership (EMF, 2013). Another, complementary definition considers CE as "a sustainable development initiative with the objective of reducing the societal production-consumption systems' linear material and energy throughput flows by applying materials cycles, renewable and cascade-type energy flows to the linear system. CE promotes high value material cycles alongside more traditional recycling and develops systems approaches to the cooperation of producers, consumers and other societal actors in sustainable development work" (Korhonen, Nuur, Feldmann, & Birkie, 2017, p.547). Furthermore, a range of CE principle categorizations have been created. These range from the '3Rs': reduction, reuse and recycle (Ghisellini et al., 2016), up to '10Rs': refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle, and recover (Potting, Hekkert, Worrell, & Hanemaaijer, 2017), whereby recover and recycle are the least effective means to maintain the product value, while refusing and reducing are the most effective, implying as little consumption as possible (see figure 1 for further elaboration).

Figure 1. Circular processing ladder.



Source: City of Amsterdam (2020)

The research on CE has long focussed on the micro-level that encompasses the adoption of circular practices on the individual company or consumer level (Ghisellini et al., 2016). The implementation of CE on the meso level implies the introduction of eco-industrial park initiatives that provide the opportunity to improve environmental performance within industrial areas (Ghisellini et al., 2016). The macro level encompasses the CE implementation on city and national levels. This paper focuses mainly on the macro level as it studies the policy instruments used by city and municipal authorities.

2.1.2 Circular city

According to literature, cities worldwide are employing CE principles to improve the resource efficiency in urban management systems (Ghisellini et al., 2016; Petit-Boix & Leipold, 2018; Turcu & Gillie, 2020). Despite this increasing attention, only little literature has emerged on the urban applicability perspective of CE (Lieder & Rashid, 2016) or how it is implemented at the local level in cities (Turcu & Gillie, 2020). Furthermore, there is little consensus of what constitutes a circular city (Paiho et al., 2020).

Attempts have been made to conceptualize it. According to the European Investment Bank (2018, p.4), a circular city is one that "conserves and reuses resources and products, shares and increases use and utility of all assets, and minimises resource consumption and wastage in all forms." Similarly, the Circular Cities Hub (2017), founded at the Bartlett School of Planning, University College London, considers that a circular city integrates characters such as systems integration, flexibility, localization, intelligence, cooperative behaviour, recycling, and renewable resources. Paiho et al. (2020, p.6) define circular city as one that "is based on closing, slowing and narrowing the resource loops as far as possible after the potential for conservation, efficiency improvements, resource sharing, servitization and virtualization has been exhausted, with remaining needs for fresh material and energy being covered as far as possible based on local production using renewable natural resources." As indicated by the definitions, circular city can be characterized by a range of features and consist of several components such as renewable energy, looped flows of waste and materials as well as circular infrastructure and built environment, to which we now turn to.

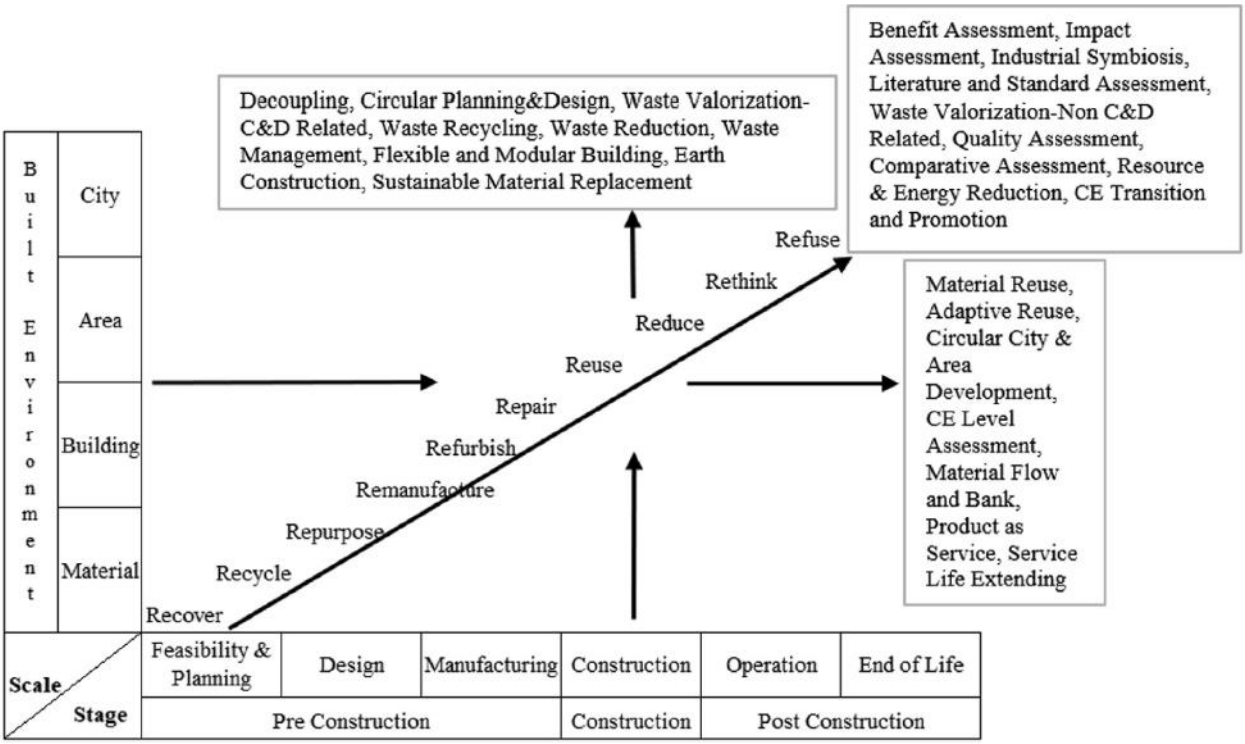
2.1.3 Circular built environment

Circular buildings and infrastructure can be defined as ones that are "designed, planned, built, operated, maintained, and deconstructed in a manner consistent with the CE principles" (Pomponi & Moncaster, 2017, p.711). The literature on circular built environment in Europe has long focussed mainly on end-of-life solutions, which has led to an improvement of the construction and demolition waste management processes (Adams, Osmani, Thorpe, & Thornback, 2017). However, concentrating efforts solely on resource efficiency and increasing rates of recycling and reuse might not be sufficient to generate circular buildings (Pomponi & Moncaster, 2017). For this, CE has other relevant applications in the built environment that can better conserve the value of products. Adams et al. (2017) present a list of a

building's life cycle stages from pre to post construction, across which CE principles can be applied. The stages cover design, manufacture and supply, construction, in-use, reuse, refurbishment, and end-of-life processing. Çimen (2021), based on an extensive literature, categorizes a building's life cycle similarly (see "x-axis" in figure 2), and presents these in relation to 10R's (circular principles as applied in the built environment, see figures 1 and 2), the different scales of built environment ranging from city all the way to material level with area and building scales in between (see "y-axis" in figure 2), and circular solutions for the built environment (as presented in boxes). In terms of scale of built environment, this thesis focusses mainly on identifying policy instruments that are used to encourage circular solutions on the 'Area' and 'Building' scales (as presented in figure 2).

Several solutions exist for implementing circularity in the built environment. In terms of circular design, concepts for disassembly, re-use and flexibility are key for enabling modular, adaptive buildings with prefabricated components, thus leading to less emissions, construction and demolition waste (Ghaffar, Burman, & Braimah, 2020). What comes to manufacturing, for example 3D printing plays an increasingly promising part in creating spaces while reducing the need for resources (EMF, 2013). In order to extend the operational life, refurbishment and adaptive reuse of (abandoned) buildings can be undertaken (Williams, 2021). Material passports and depositories for collected materials are useful in the demolition phase as material passports help to identify the materials, their potential uses and origins, and hence to assort and store them properly, while depositories stock the materials until they are used again (EMF, 2013).

Figure 2. Circular economy subject development.



Source: Çimen (2021)

Despite the range of existing solutions, wide-scale adoption is lacking and instead, solutions are often applied in isolation within a particular sector or project, with little attention paid to the economic aspects across a building's life cycle (Adams et al., 2017; Çimen, 2021). Pomponi and Moncaster (2017, p.716) recognized that "a strong voice has emerged pleading for government and policy support" in making circular practices economically viable. Certainly, the inertia within the industry and resulting slow transformation tempo make it is necessary for government actors to take initiative.

2.2 Policy instruments

The circular urban development in construction needs complex, siloes-crossing solutions as well as policy instruments designed to support their initiation. Here, policy instruments must be chosen, designed or adapted to the local context, in a way that addresses both, the roots and causes of the problem (Borrás & Edquist, 2013). In order to do so, different policies should be mixed in complementary ways. The most widely accepted and used categorization of policy instruments is the three-fold typology of regulatory and legislative instruments, economic instruments, and soft instruments (Borrás & Edquist, 2013). According to Borrás and Edquist (2013, p.1516), applying the typology generates twofold added value, namely firstly, it gives the users an orientation "in an ocean of different instruments" by providing a concise overview. Secondly, it supports the users in defining a useful criterion for the selection and design of instruments (Borrás & Edquist, 2013).

The regulatory and legislative instruments are classified as using different types of regulation and legislation to define the frameworks for the social and market interactions and hence to influence these in the desired direction (Borrás & Edquist, 2013). Such instruments are obligatory in nature, implying that actors within the established frameworks are obliged to act according to certain boundaries, defining what is allowed and what not (Borrás & Edquist, 2013). Economic instruments, on the other hand, provide monetary incentives or disincentives to support desired economic and social activities (Borrás & Edquist, 2013). These range from fiscal and economic frameworks to direct financial support. Lastly, the soft instruments are characterized by voluntariness and non-coerciveness (Borrás & Edquist, 2013). Hence, those governed by these are not obliged, sanctioned or subjected to incentives or disincentives, but rather encouraged or supported to take certain desired actions (Borrás & Edquist, 2013). Soft instruments are increasingly used and stand at the heart of 'governance', a non-hierarchical mode of decision-making and coordination in which a multitude of stakeholders participate (Bulkeley & Kern, 2006; Corfee-Morlot, Kamal-Chaoui, Donovan, Cochran, Robert, Teasdale, 2009; Lange, Driessen, Sauer, Bornemann, & Burger, 2013). Whereas economic, regulatory, and legislative instruments are considered as part of the more traditional, top-down-oriented type of 'government' (Bulkeley & Kern, 2006; Corfee-Morlot et al., 2009).

3. Methodology

This section introduces and provides a rationale for the selected methods in answering the research and sub-questions. It begins by presenting the research design, the data collection methods and the manner of analysis. Subsequently, the selected case is introduced, and the selection justified.

3.1 Research design, data collection method and data analysis

Due to the limited amount of case studies available on governance of circular transition in the built environment, the study analyses a small selection of case studies, found through a review of academic literature. Moreover, it was decided to give a specific focus on the case of Amsterdam due to its *extreme* nature. Hence, the study is a combination of a case study (document analysis on Amsterdam) and a comparative analysis (among the cases found through literature review).

This thesis asks a descriptive exploratory research question and deploys document analysis and systematic literature review (SLR) in order to sufficiently answer the research question and sub-questions. While the SLR is deployed in selecting and analysing a range of case studies, document analysis is used in studying the documents provided mainly by the municipality of Amsterdam. Denyer and Tranfield (2009, p.672) define SLR as "a specific methodology that locates existing studies, selects and evaluates contributions, analyses and synthesises data, and reports the evidence in such a way that allows reasonably clear conclusions to be reached about what is known and what is not known". In other words, SLR is a review of the existing research that addresses related issues, critically analyses these, and concludes with summarizing state of the art (Dacombe, 2016). This study aims to map out and synthesise on the policy instruments that cities and municipalities use to accelerate circular transformation in the construction sector. For this, the SLR provides an ideal research method (Burgers Brugman, & Boeynaems, 2019). Document analysis, in turn, "is a systematic procedure for reviewing or evaluating documents – both printed and electronic […] material." (Bowen, 2009, p.27). Similar to the SLR, the analytic procedure of document analysis entails finding, selecting, assessing, and synthesising data (Bowen, 2009). As a research method, document analysis is well suited for qualitative case studies that aim to produce rich descriptions of an individual phenomenon (Yin, 1994) – as is the purpose in this study.

The process of conducting a systematic review and document analysis can be divided into several stages. Firstly, the thesis formulates a specific and clear research question that can be answered through a comparison of relevant articles (Burgers et al., 2019). Ensuring that the question is specific is a prerequisite for a feasible and focused thesis (Cronin, Ryan, & Coughlan, 2008). Furthermore, three sub-questions are designed to support its answering and to provide a comprehensive overview of the regularly used policy instruments.

The second stage encompasses determining the articles to be selected for the review. It consists of rounds of literature search and literature selection. The second stage begins with a search and selection of documents on Amsterdam municipality's policy instruments. Such grey literature cannot be found through scientific databases and are hence sought with Google Search and Google Scholar as well as by searching the website of the municipality and organizations' that have contributed to writing relevant documents. Here, threefold selection criteria were used: firstly, the document should focus on circular transformation efforts in the municipality's *construction and built environment*, and secondly, it should present instruments that *have already been implemented* to support the development. Thirdly, the literature should be *in English*. In so doing, five documents were selected. These can be found in table 2. Subsequently, a search and selection of scientific literature was conducted with the scientific databases of Scopus and Web of Science. Here, the keywords 'city', 'municipality', 'governance', 'local government', 'circular economy', 'circular city', 'construction sector', 'built environment', and 'policy' were used in different combinations with the Boolean operators 'AND' and 'OR' as suggested by Cronin et al. (2008) and Cooke, Smith, and Booth (2012). Following this, a selection is made based on six inclusion criteria, as suggested by Cronin et al. (2008):

- The literature should be in the English language
- The search terms should be included in the title and/or abstract
- The articles should be published between 2011 and 2021
- The literature should be credible, of good quality, and preferably peer-reviewed
- The literature should be about a Western, high-income country, preferably in Europe
- The articles should be about (comparative) case studies

This resulted in a selection of articles that were then systematically and critically reviewed to determine which papers are included in the final selection (Burgers et al., 2019). This is done by assessing the relevance of the papers by reading the abstract, if available, as well as introduction and conclusion. Furthermore, in order to ensure that no relevant paper was missed, a backward reference searching took place, meaning that the bibliographies of the already selected papers were reviewed for other potentially relevant publications (Burgers et al., 2019). The overall selection includes 11 documents, project deliverables and articles (see table 2). The resulting collection of articles serve as the basis for answering firstly, the sub-questions, and subsequently, the research question.

Lastly, the qualitative data analysis and research software 'ATLAS.ti' was used to organize and code the documents and papers. The typology of policy instruments, as presented in table 3, served as a codebook. It is adapted from Amsterdam Circular 2020-2025 Strategy (2020). The typology was selected as it was considered very comprehensive one. The thesis used semi-closed coding process or mixed coding, as some codes (instruments) from the original framework were deleted, modified, or

added. The additional ones are highlighted in a grey. The resulting codebook includes 16 codes that are divided into three groups of regulative and legislative instruments, economic instruments, and soft instruments (see table 3 and Appendix 2). In order to facilitate a clear analysis, the study will follow the rather rigid typology of policy instruments, despite the fact that they overlap in several aspects.

Table 1. Literature selection.

Selection of (Comparative) Case Studies	Selection of Literature on Amsterdam
Prendeville et al. (2018)*: comparative case study on Amsterdam, Rotterdam, Glasgow, Haarlemmermeer, The Hague, Barcelona	**City of Amsterdam et al. (2016)**: Circular Amsterdam: A vision and action agenda for the city and metropolitan area
Campbell-Johnston et al. (2019)*: comparative case study on Amsterdam, Utrecht, The Hague	**Prendeville et al. (2018)***: comparative case study on six cities: Amsterdam, Rotterdam, Glasgow, Haarlemmermeer, The Hague, Barcelona
Bolger & Doyon (2019): comparative case study on Malmö and Melbourne	**City of Amsterdam et al. (2018a)**: Amsterdam Circular: Evaluation and Action Perspectives
Turcu & Gillie (2020): case study on London	**City of Amsterdam et al. (2018b)**: Municipal Policy for the Circular Economy: Lessons Learned from Amsterdam
Williams (2021)*: case studies on London, Stockholm, Amsterdam and Paris	**Campbell-Johnston et al. (2019)***: comparative case study on three cities: Amsterdam, Utrecht, The Hague
Christensen (2021): comparative case study on the Bornholm municipality and Rødovre municipality	**City of Amsterdam et al. (2019)**: Building blocks for the new strategy Amsterdam Circular 2020-2025
	City of Amsterdam (2020): Amsterdam Circular 2020-2025 Strategy
	Williams (2021)*: comparative case study on London, Stockholm, Amsterdam and Paris

* The information on the case study of Amsterdam will be utilised in the analysis of the literature on Amsterdam, whereas the other case studies will be used for the analysis of the literature on (comparative) case studies.

*Table 2. List of cities and municipalities with policy instruments implemented for circular development in built environment.**

Amsterdam (NL)
Bornholm (DK)
London (UK)
Malmö (SE)
Melbourne (AU)
Paris (FR)
Stockholm (SE)
Utrecht (NL)

*The table lists the cities and municipalities that have demonstrated accomplished actions for CE transformation and that the following analysis focusses on.

Table 3. Codebook presenting policy instruments.

Regulatory & Legislative Instruments	Regulations	Strategy & objectives
		Spatial planning
Economic Instruments	Fiscal frameworks	Taxation
	Direct financial support	Subsidies
		Circular procurement & infrastructure
		Tendering & land allocation
Soft Instruments	Knowledge, advice & information	Research activities
		Information (campaign)
		Capacity building
		Experimentation
	Collaboration platforms & infrastructure	Facilitation & coordination
		Data & information exchange platforms
		Living labs
	Governance	Institutional design
		PPP
		Lobbying

Source: Adapted from Amsterdam Circular 2020-2025 Strategy (City of Amsterdam, 2020)

3.2 Case selection and description

The central case of the study is Amsterdam that was selected for its *extreme* or *unusual* nature. The city is promoted as a pioneer and has made significant efforts to transform its built environment into a circular and sustainable one (City of Amsterdam, 2020; Doughnut Economics Action Lab (DEAL), Biomimicry 3.8, Circle Economy, & C40, 2020; Williams, 2021). Hence, the municipality clearly deviates from the average circular cities and municipalities (Seawright & Gerring, 2008).

Amsterdam is the most populous city in the Netherlands with a dynamic, service-oriented economy and a range of major international companies, and smaller start-ups (Williams, 2021). Besides, the city has leading research institutes and consultancy companies as well as good connections to the rest of Europe (Williams, 2021). These aspects make Amsterdam a hub of knowledge, creation, innovation as well as cultural, economic, and business activities, making the city an ideal ecosystem and testbed for urban circular developments (Williams, 2021). Since 2015, as the City first adopted a Sustainability Agenda – of which CE is a central part – it has introduced a range of circular policy instruments, initiatives, experiments, ambitions, and monitoring efforts within its territory, often in cooperation with private actors (Prendeville et al., 2018). The Agenda further proposed that Amsterdam would become a testing arena for circular district development and CE activities (Williams, 2021). The long-term ambition was

to establish a CE involving novel methods of production, distribution and consumption (Williams, 2021).

According to a conducted Circle City Scan[4]- resource analysis, the construction sector is one of the two most significant material flows within the Amsterdam's urban region due to the volume of imported construction materials and exported demolition waste (Williams, 2021). This is not surprising, as it is estimated that the city grows ca. 23% in population until 2040, implying an increase from the current 834,000 to over 1,000,000 inhabitants (Williams, 2021, p.54). The increasing number of inhabitants puts pressure on Amsterdam and its municipal neighbours to continuously build new dwellings, provide associated services and experiment with different sustainable living solutions (Williams, 2021). Taking this information together, it can be argued that the settings for Amsterdam's circular construction development provides a unique example. Therefore, an in-depth analysis of this unit contributes well to answering the research question (Gerring, 2004). Representativeness cannot be achieved, which however, is not a purpose of the study because if an extreme case becomes representative, it is no longer unusual. Hence, non-representativeness is not a limitation but rather a prerequisite to the study, providing a fruitful fundament for the following exploration (Seawright & Gerring, 2008).

4. Analysis

This chapter presents the findings of the literature review based on the typology of policy instruments as presented in the section 3.1. Firstly, the results from the analysis on the selection of (comparative) case studies on the policy instruments used for CE transformation in the construction industry are presented, thereby answering the sub-question 1. Following this, the outcomes of the literature review analysis on Amsterdam will be introduced, providing an answer to the sub-question 2.

4.1 Policy instruments for circular development in the built environment

4.1.1 Regulatory and legislative instruments

The analysis highlighted that most of the studied cities and municipalities pay limited attention to the legislative instruments due to their limited mandate, and instead, focus on regulatory, economic, and soft instruments. However, setting *strategies* and defining clear *objectives* for achieving the CE implementation in the construction sector and in the city at large was used widely across the studied cases. Cities and municipalities that aim towards circularity in the urban ecosystem, including built environment, have either established circular economy strategies (e.g., Paris, London, Utrecht) or sustainability strategies with explicit CE ambitions and objectives (e.g., Melbourne) (Prendeville et al., 2018; Campbell-Johnston, ten Cate, Elfering-Petrovic, Bolger & Doyon, 2019; Gupta, 2019; Turcu &

[4] Circle City Scan Tool allows "local governments to discover and prioritise circular opportunities for their city or region, based on proprietary and publicly available socioeconomic and material flow data, relevant circular case studies, and users' input as to which sectors, materials, and impact areas are a priority in local agendas." (Circle Economy, n.d.).

Gillie, 2020; Williams, 2021). Interestingly, Stockholm does not have a CE strategy, the city, however, has embedded circular thinking into its policies, infrastructure, and services for over two decades (Williams, 2021).

Despite acknowledging the potential of *spatial planning* in the implementation of CE, the studied cities and municipalities use it to a limited extent, which can stem from the observation that local planning authorities do not necessarily know how to operationalise CE in practice (Turcu & Gillie, 2020). The Greater London Authority (GLA), for example, requires circular construction principles to be adopted for strategic sites (Williams, 2021), however little evidence has been found of their effective incorporation in the spatial planning tools that the city's local authorities use (Turcu & Gillie, 2020). London and Paris – both land scarce cities – use temporary planning permissions to enable local communities to repurpose abandoned buildings and spaces for low value activities such as recreation and temporary housing, that would otherwise not realise in the highly competitive environments (Williams, 2021). Stockholm, in turn, deploys flexible and collaborative planning in one of its circular development areas (Stockholm Royal Seaport) to construct adaptable spaces and buildings while engaging local communities in the supply of the built environment (Williams, 2021).

4.1.2 Economic instruments

The type and extent to which economic tools such as *taxation* and funding are used to implement the CE transformation is highly dependent on the national context and the vertical distribution of powers, as shown by Bornholm, Stockholm and Malmö on the one hand, and Melbourne and London on the other. The municipal mandate of Stockholm, Malmö, and Bornholm allows the cities to levy taxes for local activities, providing them with greater control over local transactions and allowing the cities to choose to use the revenues to support local circular development (Bolger & Doyon, 2019; Williams, 2021). The neoliberal national agenda of Australia and the UK, in turn, has led to deregulation and resulted in constrained mandates and funding opportunities for cities such as Melbourne and London (Bolger & Doyon, 2019; Williams, 2021). In London, the funds for local sustainable infrastructure provision and circular start-up support are "extremely limited" (Williams, 2021, p.51), hence the GLA is currently developing further financial tools. In order to encourage the reuse of vacant properties, London has further imposed a tax on empty homes and dwellings.

Capital and operational *subsidies* are broadly used in Paris, Stockholm and London for transforming business models, infrastructure and services, as well as in Bornholm for supporting new circular practices in building demolition (Christensen, 2021; Williams, 2021). Moreover, the studied cities and municipalities use *circular procurement*, *tendering* and *land allocation* to support circular businesses and practices (Campbell-Johnston et al., 2019; Bolger & Doyon, 2019; Williams, 2021). The city authorities of London and Paris have included CE ambitions in their public procurement schemes. Moreover, Paris uses the instrument as the main means of public funding and has defined a resource

efficiency criterion for its upcoming public acquisitions, helping to deliver the most resource-efficient outcomes in the region (Williams, 2021). Furthermore, the city has developed an application for calculating the ecological footprint of procurement (Williams, 2021). This has proven beneficial in stimulating and monitoring the implementation of circular procurement policies (Williams, 2021). The GLA, on the other hand, has used procurement in several targeted projects such as the Olympic Park development (Williams, 2021). Similarly, tendering and land allocation are used by some of the cities to support the integration of CE principles in the built environment (Campbell-Johnston et al., 2019; Williams 2021). For instance, the GLA allocates publicly owned land, whereas Paris releases both publicly and privately owned land for (low value) activities that help to deliver circular development and infrastructure (Williams 2021). Moreover, the Paris' mayor initiated a strategic adaptive reuse process in which abandoned sites and buildings are tendered to developers and architects according to a set of circular requirements (Williams, 2021).

4.1.3 Soft instruments

Despite acknowledging the potential of *data exchange platforms* in learning and identifying opportunities for resource exchange, such platforms have been rather little implemented (Williams, 2021). While most of the cases do not cover this tool, London focusses on supporting start-ups that create data platforms (e.g., 'Sustainability Cloud' for exchanging concrete or 'Biohm' for mushroom-based building insulation), while the Paris municipality takes a direct approach by setting up such platforms itself (e.g., 'Paris Urban Metabolism Platform') (Williams, 2021). Local *information exchange platforms,* in turn, serve in the knowledge dissemination process among local industry stakeholders and public authorities as has been done in Bornholm, London and Paris (Christensen, 2021; Williams, 2021). Williams (2021) further highlights the power of (inter)national information exchange networks such as Circular Economy Club, C40 Cities, and Eurocities that some of the cities and municipalities are part of.

Organizing education, training workshops, fora, and resident groups, providing an opportunity to participate in collaborative planning, establishing local and (inter)national networks, building trust, communicating, and engaging a range of stakeholders in decision-making and other processes contribute to local knowledge and skills capacity that are emphasized by Christensen (2021) and Williams (2021) as central enablers of transformation. While Stockholm focusses on building the different types of capacity among the local government departments, residents, and communities within the areas under circular development, London and Bornholm have taken an industry centred approach, targeting business actors with *capacity building* actions and services (Williams, 2021; Christensen, 2021). Paris, in turn, seems to integrate both approaches through multi-stakeholder processes (Williams, 2021).

Several of the covered cities and municipalities consider *facilitation and coordination* as one of their main functions in the transition. This involves mobilizing citizens and local stakeholders (Prendeville et al., 2018), coordinating partnerships (Bolger & Doyon, 2019), supporting communication and networking (Christensen, 2021), and using suasive engagement (Campbell-Johnston et al., 2019). Furthermore, the local authorities can *lobby* circular construction and management processes in specific developments (Bolger & Doyon, 2019; Turcu & Gillie, 2020; Williams, 2021). However, as Bolger and Doyon (2019, p.2194) illustrate by citing an interviewee, "local government can lobby and advocate for good decisions but for a circular economy to work it needs the whole city working together and for everything to be talking to each other" – engaging a breadth of stakeholders through different types of *partnerships* is key to a successful implementation. Triple and quadruple helix governance models[5], although not always termed this way in the literature, were often indicated as powerful vehicles for the CE implementation (Bolger & Doyon, 2019; Turcu & Gillie, 2020; Williams, 2021). The latter was considered important in the realization of urban *living labs* that was seen as a central part of the approach in Malmö, however, less so in other studied cities (Bolger & Doyon, 2019).

Other forms of *experimentation* are more common and include circular pilot projects (Campbell-Johnston et al., 2019), fablabs[6], and temporary programs that are established in several cities (Williams, 2021). The popularity of the experimental projects lies in the value of their output. They, namely, provide the opportunity to explore the challenges and solutions to the CE implementation (Williams, 2021), leading to expected results, surprising outcomes or failures, of which specifically the two latter ones can serve as important learnings for future developments (Bolger & Doyon, 2019). As shown in the cases of Paris, London, and Stockholm, an experimental approach offers the greatest potential for familiarizing residents and communities with circular developments through their involvement, while supporting large-scale adoption of CE, and potentially creating demand for circular products and practices in the local built environment.

While the benefits of coherent governance and cross-departmental approaches on CE implementation are acknowledged in some cities, siloed working seems to remain as the defining feature of the local *institutional design* (Bolger & Doyon, 2019; Turcu & Gillie, 2020). Cities such as Melbourne and some of the London's boroughs, however, have initiated municipal alliances and borough partnerships, respectively (Bolger & Doyon, 2019; Turcu & Gillie, 2020). These are used to share knowledge of materials and their use, as well as to engage stakeholders in sustainable development initiatives (Bolger

[5] While the triple helix governance model involves public and private sectors as well as knowledge institutions, the quadruple helix governance supplements this combination of stakeholders with the public, including communities, citizens, and media.

[6] Fablabs are digital fabrication laboratories, meaning a place dedicated to innovation and learning (The Fab Foundation, n.d.). Playing, creating, and mentoring play central part of these activities (The Fab Foundation, n.d.). Fab labs provide access to the skills, space, materials, and advanced technology essential for creation (The Fab Foundation, n.d.).

& Doyon, 2019) or to exchange inspiration, and solutions to a range of issues emerging during the implementation (Turcu & Gillie, 2020). Moreover, these partnerships support the CE implementation on scale (Turcu & Gillie, 2020) and can counteract the consequences of an ineffective governance approach of the municipality to some extent, however, not substitute it. Stockholm provides perhaps the best counterexample by building institutional capacity within local government departments to realise circular developments within its territory (Williams, 2021).

4.1.4 Answering the sub-question 1

The analysis shows that different policy instruments from the three introduced groups are used to varying extents by the local authorities in these – mainly European – cities and municipalities. Despite the great variation among the analysed cases, a general pattern of used instruments can be identified. In order to provide an answer to the sub-question 1: *What are the central policy instruments that local governments use to support the circular development in the local built environment?*, this section briefly introduces this pattern, thereby summarizing the findings of the above analysis.

As highlighted, the national context in which cities and municipalities are embedded in, has a significant influence on the selection of the policy instruments, especially what comes to the regulative, legislative, and economic instruments. The absence of CE related legislation clearly results from the limited legislative mandates of the local governments, whereas the limited number of identified relevant regulations can be, at least partially, derived from the lack of local authority owner- and leadership as well as limited municipal capacity. However, it must be emphasized that most cities use extensively *strategies*, plans and *objectives*, as well as *spatial planning* tools to support and initiate circular development.

While the Nordic cities and municipalities have a greater mandate in terms of economic instruments and hence are better equipped to financially support and steer the local circular development, Melbourne and London show how the national neoliberal agenda and market deregulation can impair the local regulation and funding mechanisms. Despite this, almost all the analysed cities and municipalities used instruments such as *taxation, subsidies, procurement, tendering and land allocation.*

Although soft instruments are often seen as complementary to regulatory, legislative and economic instruments, they play a significant role in the analysed cases. This, however, is not surprising as the municipal mandate often allows the use of soft instruments, in contrast to the other instruments (regulatory, legislative, economic), which can create conflicts with the national policies more easily (Bolger & Doyon, 2019). Interestingly, while the regulatory and economic instruments appear to be used in certain cities and municipalities, soft instruments are used in all the studied cases to varying extents. These include *data and information exchange platforms*, *capacity building*, *facilitation and coordination*, different types of *partnerships*, *living labs* (directly mentioned only in Malmö), other

types of *experimentation*, *lobbying* and transforming the *institutional design*. These types of instruments are used to increase the knowledge capacity of the stakeholders, initiate and improve collaboration, and to ensure that the governance framework within which the transformation takes place, is suitable and capable to facilitate these processes. These are fundamental functions due to the novelty of circular development to the built environment and hence play a significant role in the adoption of new practices.

4.2 Policy instruments for circular development in Amsterdam's built environment

4.2.1 Regulatory and legislative instruments

Only a limited number of legal instruments have been deployed in recent years to support the circularisation of the built environment in Amsterdam due to the municipality's limited legislative mandate (City of Amsterdam, Copper8, & Circle Economy, 2018b). Such limitations, however, will at least partly subside from 2022 onwards as the Dutch Environment and Planning Act comes into effect (Netherlands Enterprise Agency, n.d.). By enabling more flexibility and local solutions, the Act allows the municipality and other local governments to set requirements for circular construction and demolition (City of Amsterdam et al., 2018b; Netherlands Enterprise Agency, n.d.).

As Amsterdam's circular development is still in the beginning, *strategies and objectives* constitute a significant part of the city's approach. The city's sustainability agenda, 'Sustainable Amsterdam', adopted in 2015, was the first document to include a full action program on circularity (Prendeville et al., 2018). It proposed that the city would become a testbed for circular district development and CE activities (Williams, 2021). In so doing, it aimed to establish itself as a pioneer in delivering CE and thereby gain economic advantage (Williams, 2021). Furthermore, in 2016, the Amsterdam Metropolitan Region spatial and economic development plan was published that included CE transformation in the development process (Williams, 2021). Furthermore, in 2017, the municipality launched its first guideline for circular buildings with four strategies addressing different aspects of circular construction and stimulating the private sector to develop circular built environment (Williams, 2021). In 2020, Amsterdam launched the 'Amsterdam Circular 2020-2025 Strategy'. It introduces a comprehensive agenda, action points, and objectives for the three most critical circular value chains in the city, one of them being the built environment. According to the Strategy, the city aims to formulate circular ambitions for each districts' built environment in consultation with stakeholders by 2023. These will provide the basis for development, transformation, and management of the city and its districts, and serve as the foundation for a range of arrangements with stakeholders in each district. Thereby, the city will require all construction projects to formulate circular ambitions, except when the project investment budget cannot afford this (City of Amsterdam, 2020).

Spatial planning is a central method in the realisation of circular development in built environment in Amsterdam. By safeguarding circular ambitions such as high-value reuse of buildings, components or

materials or the construction of smart buildings in spatial planning policy, all stakeholders are obliged to follow them, creating demand amongst developers (City of Amsterdam, Circle Economy, & Copper8, 2018a; Williams, 2021). Circular development in the built environment requires a degree of experimentation due to its novelty. In order to allow this, the municipality eases restrictions, hence allowing flexible zoning or zones with only a few or no restrictions (City of Amsterdam, TNO, & FABRIC , 2016). An example of the latter are legislative "free-zones", established, for instance, on the post-industrial area of Buiksloterham (Prendeville et al., 2018; City of Amsterdam et al., 2016). De Ceuvel – an experimental living lab – is one of the free-zones for which the municipality relaxed planning conditions and instead set requirements to its performance (Williams, 2021). This approach allows testing novel designs, exploring regenerative approaches and implementing circularity in practice, hence serving as an important enabler of circular development (City of Amsterdam et al., 2016; Prendeville et al., 2018). In order to regenerate some of its larger districts (e.g., Buiksloterham), Amsterdam uses organic development (Williams, 2021). Here, the development is not based on a masterplan but a set of goals and an informal roadmap that provide a vision and allow the site to evolve in a manner that suits the local needs (Williams, 2021).

4.2.2 Economic instruments

The review shows that the City of Amsterdam uses its large purchasing volume, discretion and control over purchases to act as a launching customer for circular products and services (City of Amsterdam et al., 2018b). Thereby, it aims to stimulate demand for circular construction by employing circular criteria in public *procurement* for all construction-related projects, hence creating a market for circular products (City of Amsterdam, & Circle Economy, 2019). Such demand influences the supplier directly, which in turn effects the rest of the value chain (City of Amsterdam et al., 2018a). In the recent years, several circular procurement processes have been carried out, with the reuse of old baked bricks from 2018 onwards as one of the best-known examples (City of Amsterdam et al., 2018a). Furthermore, Amsterdam has adopted a circular *tendering* policy for city-wide use and established tendering criteria, involving aspects such as high-value recycled products, components and materials (City of Amsterdam et al., 2018a; Williams, 2021). The criteria have been applied in *allocating land* and buildings for urban transformation, infrastructure renovation and demolition (Williams, 2021). The municipality owns large areas of land due to its leasehold system, issues it on a regular basis, and has hence considerable power to reinforce the criteria in the city (City of Amsterdam et al., 2018a). Buiksloterham is one of the four public lands that have been successfully tendered with circular criteria since 2017 (Williams, 2021). In addition, *taxation* is used to encourage circular business practices, discourage non-circular performance and prevent grey waste (Prendeville et al., 2018; Campbell-Johnston et al., 2019).

In order to scale up circular innovations to a commercially viable level, public financial support is regularly needed (City of Amsterdam, & Circle Economy, 2019). For this, the municipality has dedicated a *subsidy* scheme for sustainable initiatives to financially support circular infrastructure,

business models, and service provision as well as developed a local currency that has been tested in the living lab De Ceuvel to encourage local circular activities (Williams, 2021). In order to better support circular businesses, Amsterdam aims to expand on the variety of existing commercial and financial instruments to encourage circular construction practices by investors, owners and managers (e.g., of commercial real estate) (City of Amsterdam, 2020).

4.2.3 Soft instruments

Data and information exchange platforms are important vehicles in the acceleration of the circular transformation in the city's built environment. The Circle City Scan is one of the most important platforms as it provides information about construction and demolition waste flows in the city-region (Williams, 2021). Another central online platform is PUMA that identifies the vicinity and availability of high-value metals in the built environment, marked in a geological map of the city-region (Williams, 2021). Such platforms are a prerequisite for the effective exchange of recycled or reused materials and establishing local supply chains, while simultaneously serving as a digital marketplace (Williams, 2021). Several other networks and information exchange platforms have been developed in the city to facilitate knowledge transfer and cooperation on circular construction practices, such are, for example, Cirkelstad, Amsterdam Smart City, Netwerk Betonketen Amsterdam (City of Amsterdam et al., 2018a; Williams, 2021). On the international level, Amsterdam chairs the Circular Economy Task Force of Eurocities and is involved in the C40 cities network which allows the municipality to share lessons learned with other cities (Williams, 2021).

The City of Amsterdam, in cooperation with local stakeholders, has implemented several *living labs*. This has proven to be a highly successful approach for engaging a variety of stakeholders, testing circular solutions, and demonstrating circular construction methods (City of Amsterdam et al., 2018b; Williams, 2021). The experiences made in the city indicate that the living labs are best realised through a quadruple-helix governance model in which citizens, local government, private sector, and knowledge institutions participate (City of Amsterdam et al., 2018b). The involvement of the end-users is essential to ensure that new practices and systems are implemented and applied in the most impactful manner (City of Amsterdam et al., 2018b) and that the inhabitants appropriate these by changing attitudes and social practices (Williams, 2021). The living labs are admitted a specific status (e.g., free zone) by the municipality. This involves loosened restrictions in the area, hence allowing space for *experimentation* and circular innovation. Numerous experiments beyond living labs, such as pilot projects and fablabs, are located in the city, and several businesses, including circular start-ups, have been initiated in cooperation with local stakeholders as part of the two circular programmes launched by the municipality in 2016: 'Amsterdam Circular: Learning by Doing' and 'Circular Innovation Programme' (Prendeville et al., 2018; Campbell-Johnston et al., 2019; Williams, 2021). Experimentation is a central accelerator of circular innovation and development as the domain is new and many issues and context specific solutions need to be discovered (Prendeville et al., 2018). It is also used to prove that circular

development can be profitable, hence encouraging wider adoption. The experimental practices and processes are supported by "learning by doing"- and "learning from successes and failures"-mindset, that provide a valuable basis for the development (City of Amsterdam et al., 2018a).

Research institutes play a central role both in the development in general and more specifically in the living labs by providing benchmarking research on sustainable and circular solutions for issues in the urban built environment, thus helping to develop a more thorough understanding (City of Amsterdam et al., 2018a). Here, research and consultancy institutes such as the Amsterdam Institute for Advanced Metropolitan Solutions, Amsterdam University of Applied Sciences, Metabolic, and the Circle Economy are important partners (Prendeville et al., 2018; City of Amsterdam et al., 2018a). The Circle Economy, for example, has developed a platform – Circle Scan – that identifies the city's physical resource flows, thereby guiding policymakers in managing the local resources effectively (Prendeville et al., 2018). Furthermore, research has been conducted on Amsterdam's potential for urban mining[7] in building materials (PUMA), the costs and benefits of circular construction, as well as land allocation in the city (City of Amsterdam et al., 2018a).

The Municipality of Amsterdam invests in knowledge development and CE competencies (*capacity building*), for example, through the organization of the 'Circular Innovation Programme'. Thereby, relevant stakeholders, such as building contractors, have received training in circular procurement and construction processes (City of Amsterdam et al., 2018a; Williams, 2021). As a result, supply and knowledge chains for circular construction have started to develop in the city, increasing actors' awareness, understanding and expertise (Williams, 2021). A further success factor has been the quadruple helix governance model that has created a learning environment – a "transition arena" (City of Amsterdam et al., 2018a, p.41) – in which new initiatives can be established and knowledge is being exchanged. In order to support internal information distribution, the Municipality is arranging "an expertise centre to provide the relevant municipal departments with practical advice about circular construction practices and urban development and to identify restrictive legislation and regulations and get these on the agenda" (City of Amsterdam, 2020, p.69).

4.2.4 Answering the sub-question 2

This section briefly summarizes the findings and answers the second sub-question: *What are the central policy instruments that the municipality of Amsterdam uses to support the circular development in the local built environment?*

The analysis shows that while legislative instruments play a rather insignificant role, regulations such as *strategies and objectives* and *spatial planning* are key tools for the municipality of Amsterdam. The objectives and strategies illustrated in the literature clearly show the municipality's will and

[7] The process of recovering and reusing materials that locate in an urban environment (Blok, 2021). These can originate in buildings, infrastructure, or products that are not anymore in use (Blok, 2021).

preparedness to lead in the circular transformation, locally, nationally and internationally. Spatial planning is clearly the most important instrument in the development as it obliges stakeholders to produce circular built environment. In terms of economic instruments, the municipality uses mainly forms of direct financial support to assist circular enterprises and create market for circular businesses, infrastructure, and services. Here the most used instruments are *circular procurement, tendering and land allocation,* and *subsidies*. *Taxation* is deployed to discourage non-circular performance, prevent grey waste as well as to encourage circular businesses. Clearly, the number of used soft instruments constitute the biggest part of the overall number of instruments. Thereby, the instruments used for knowledge creation (*capacity building, research, experimentation*) and increasing collaboration (*data and information exchange platforms, living labs,* different types of *partnerships*), play the most significant role.

5. Discussion

The presented findings are now discussed to answer the third sub-question of the thesis: *To what extent does the municipality of Amsterdam use the same policy instruments as the other case studies?* While it is clear that the cases cannot be entirely compared due to the uneven amount of studied materials, this chapter aims to outline indications that shall be confirmed with further studies.

Similar to the case studies, the municipality of Amsterdam barely uses legislation as a support mechanism of circular development in its local built environment due to its current limited legislative mandate. This, however, is likely to change in the upcoming year due to the envisaged enactment of the Dutch Environment and Planning Act in 2022 that will allow municipalities a greater mandate in setting requirements on circular construction and demolition. It remained unclear whether similar legislation is planned in the national contexts of the other case studies. *Strategies and objectives* are clearly central to all the cities' and municipalities' approach. While Amsterdam and Paris have established strategies and objectives for the circular transformation of the built environment, London has a plan for general circular development, and others, such as Melbourne, have integrated circular ambitions in their sustainability agendas. The varying approaches can be similarly observed in the use of *spatial planning*. While Amsterdam uses a range of spatial planning tools, most notably organic development, and restriction reliefs (e.g., free zones), Paris and London – the ones using spatial planning the most compared to other case studies – deploy mostly temporary planning permissions.

As with legislative and regulative instruments, the municipality of Amsterdam uses same economic instruments as identified in some of the other case studies, namely, *procurement, tendering and land allocation, subsidies,* and *taxation*. Only the specific policy objectives and the extent to which the instruments are used, appears to vary. In terms of tendering and allocation, the municipality of Amsterdam owns significant amounts of land and regularly issues this, thereby reinforcing the circular tendering criteria on developments. Paris – clearly the closest case to Amsterdam in terms of used policy

instruments – allocates public and private land. However, the activities taking place on private land are temporary and often low value, hence the produced circular activities are not permanent, nor are they being scaled up. Due to the limited amount of available land for long terms uses, Paris cannot demand circular construction through tendering to the same extent as Amsterdam. Regarding procurement, Paris and Amsterdam use it more regularly than the other studied cases on average. Subsidies appear to be used regularly across the cases. Taxation, in turn, is highly dependent on the national context, hence it is used varyingly in different cities and municipalities.

The analysis on soft instruments indicates the most differing results in terms of used instruments. Firstly, the number of instruments found in the group of case studies was slightly greater than the soft instruments identified in Amsterdam. This can be explained by the greater number of studied cases. Consequently, the used instruments differ. While the most used instruments are *data and information exchange platforms*, *capacity building*, *partnerships*, and *experimentation*, only Amsterdam emphasizes the use of *research*, whereas other cities and municipalities highlighted *facilitation and coordination*, *lobbying* and *institutional design* as significant measures to support circular development. What comes to *living labs*, only the literature found on Malmö and Amsterdam recognizes these. The findings indicate that most of the studied cities and municipalities, including Amsterdam, use capacity building and experimentation to increase the existing knowledge and skills of relevant stakeholders, while improving collaboration through partnerships and a variety of platforms. Amsterdam, however, takes a step further on both by investing in research activities that make a crucial contribution in the knowledge development on circular transformation. Further, it sets up living labs with stakeholders to provide a testbed for circular development. Other cities and municipalities, in turn, focussed strongly on facilitation and coordination, as well as establishing institutional arrangements within the municipal departments, and lobbying both, local stakeholders and decisionmakers on a national level to provide supportive legislation and funding.

To conclude, it can be stated that the municipality of Amsterdam uses largely same instruments as other cities and municipalities do. The major difference lies in the extent to which the cities and municipalities deploys the policy tools, the combinations they are used in, and the policy objectives– which in turn influence how they are implemented. Soft instruments make another key difference. While Amsterdam is focussed on knowledge creation and collaborative development, other cities and municipalities seem to concentrate more on operation within the governance apparatus but also on facilitation and cooperation of actions that support circular development in the built environment.

6. Conclusion

While much of the literature on CE governance in cities and municipalities is about drivers and barriers, this study set out to outline the little explored policy instruments that cities and municipalities use in order to support the circular development in the local built environment. Here, it firstly mapped out the

instruments used in cities and municipalities of Bornholm, London, Malmö, Melbourne, Paris, and Utrecht, thereby providing a general overview of instruments used across Europe. Subsequently, it charted the policy instruments used by the municipality of Amsterdam to gain a detailed overview of its approach. Following this, the policy instruments used by Amsterdam were compared with the findings provided by the first analysis to see to which extent the cities and municipalities use similar instruments. Finally, this thesis aims to pinpoint the instruments that distinguish Amsterdam's approach as it is often promoted as an exemplary case in the CE transformation. Thereby the central research question of the thesis, *Which policy instruments, implemented by the municipality of Amsterdam to support the circular development in its built environment, distinguish the municipality's approach from the ones of other cities and municipalities?,* is answered.

It can be argued that only the use of research activities distinguishes the municipality's approach from other cities and municipalities. Indeed, these play a significant role in the circular development of the city's built environment by contributing to a better understanding of circular construction and material flows within the city, as well as by testing and finding solutions. Considering the other used instruments, it is the degree to which Amsterdam combines and implements these that generate the city's successful approach. For example, by having implemented several living labs, the municipality has brought together different local stakeholders – residents and community, research institutes and enterprises – that are essential for the successful adoption and implementation. By enabling different spatial planning tools, the municipality allows experimentation, context suitable solutions and innovation in these areas. Furthermore, as described in one of the documents, Amsterdam has managed to establish an arena of transformation that, through a quadruple helix governance model, allows capacity building, creation of initiatives and exchange of knowledge. The municipality of Amsterdam hence provides a great example of the key role that soft instruments – often considered as less important and complementary to legislation, regulation, and economic instruments – can play in circular development when used properly. Overall, it can be argued that instead of using different instruments than other cities and municipalities, Amsterdam uses the same policy instruments but in a rather comprehensive manner, reflecting the municipality's ambitious approach to circular transformation of its built environment. Thereby, the city's approach seems to well correspond with the one suggested by Remøy, Wandl, Ceric, and van Timmeren (2019) that highlighted a successful approach as one that combines a multifaceted governance approach with developing living labs, involving key stakeholders, gathering and sharing learnings, systems thinking, and proposing a joint circular design approach with stakeholders. However, it remains to be researched to which extent the approach of the municipality is more comprehensive and the policy mixes more successful than the ones of other cities and municipalities.

Hereby, it must be emphasized that several factors beyond sole policy instruments benefit the municipality in its efforts to transform its built environment into a circular one. These stand out as central

enablers and hence are briefly presented here. Firstly, instead of staying within its administrative boundaries, the municipal authorities appear to take a notably proactive role and show considerable political ownership of the project. This involves accepting the (economic) uncertainty and chance of failure that come with the novel phenomenon, learning from these and sharing the learnings across municipal and external networks, openness towards new, and allowing sufficient time for the processes. This approach could be also termed as 'trial-and-error'. Secondly, the locally prevailing attitude of openness towards innovation and new approaches (as highlighted in the section 3.2) and citizens, communities, knowledge institutes and enterprises working on sustainability solutions, provide the municipality a highly favourable ground for putting forward the development. Thirdly, the national context supports local governments in circular development of construction and built environments. The Dutch government, namely, has introduced a national Circular Economy programme in 2016 (The Ministry of Infrastructure and the Environment, & the Ministry of Economic Affairs, 2016) and a specific Transition Agenda for Circular Construction Economy for the years 2018-2021 (The Ministry of Infrastructure and Water Management, 2018). Lastly, as the financial capital of the Netherlands and a commercially dynamic city (URBACT, n.d.; Williams, 2021), the municipality of Amsterdam is economically in the position to support the realisation of circular development within its territory.

6.1 Research limitations

Three different research limitations can be observed. Firstly, the greatest limitation of the research is the lack of in-depth analysis of the selected case studies of Malmö, Melbourne, Utrecht, Paris and London, due to the small amount of information collected on them. This weakness, however, can also be seen as a strength of the study. Namely, the approach allows involving and studying a variety of cities and municipalities, instead of only two cases, which would be feasible in the context of this thesis. The number of included cases provide a broader overview of the policy instruments used in this mainly (Western) European context. The lack of in-depth analysis, while relying to existing studies on policy instruments, however, can lead to exclusion of existing, relevant instruments that were not mentioned in the selected literature. This is key to why making certain inferences from the comparison is infeasible. Furthermore, as emphasized by Turcu and Gillie (2020, p.70), "city comparisons can be far-fetched and missing important cultural and contextual factors", hence the richness and complex effects of the local contexts are not necessarily taken sufficiently into consideration. Thus, the results can be considered as indications, meaning that more qualitative in-depth analysis is necessary to confirm the findings (see section 6.2 for recommendations on this).

Secondly, due to the limited resources available for the research, only a systematic literature review (on academic literature) and document analysis (documents provided by the municipality of Amsterdam) were conducted. With a longer time period, other research methods, such as interviews, could have been utilised to confirm the findings.

Lastly, a further limitation lies in the fact that the study has been conducted by a single researcher, indicating that the influence of cognitive bias cannot be excluded. However, an effort was made to counteract bias in the coding process by letting another student to inspect a random coding example.

6.2 Research agenda for future

This study serves as an initial exploration of the policy instruments that are used by cities and municipalities across Europe to support circular development in built environment, and as such, should be considered as a starting point for further research. For this, the thesis makes four types of recommendations. Firstly, in order to confirm the findings of this study it would be essential to conduct a qualitative cross-case analysis between, for example, the cities of Amsterdam, and Paris, as the analysis indicates these to have similar approaches, be on the European forefront of circular transformation in the built environment, and thus comparable. For this, a range of different data collection methods such as documents, academic literature and expert interviews should be extensively used to create a more comprehensive, in-depth understanding of the policy instruments used by the cities.

Secondly, the findings of the analysis indicate that all the studied cities and municipalities, including Amsterdam, are only at the beginning of circular development in the built environment. The novelty of the phenomenon is further illustrated by the lack of literature and case studies. Yet, the covered cases demonstrate enormous potential for learning – a potential that should be utilized within these cities as well as in other contexts. In order to support circular development in cities, it would be important to further study best practices. Hence, more case studies are needed on the effects of implemented policy instruments and policy combinations on their outcomes to make recommendations. This can be produced, for example, through an interrupted time series design in which municipal authorities and other relevant stakeholders (industry actors, knowledge institutes) are interviewed or asked to fill out a questionnaire before and after the implementation of certain instruments to then evaluate their effect and effectiveness.

Thirdly, limited attention was paid in the research to the other, rather local factors that have a significant influence on which instruments are implemented as well as the policy outcomes. Hence, it is hereby recommended that more research is conducted on these aspects, firstly, through individual case studies in order to understand the effect of the specific context, and secondly, through cross-case analysis to compare the effects. This would help creating policy recommendations for specific contexts and give perspective on the range of contexts and effects.

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Appendix

A. Studied literature

This appendix lists literature used in the document analysis and literature review.

Selection of (comparative) case studies used in the literature review

Author(s)	Year	Title	Type of literature
Prendeville, S., Cherim, E., & Bocken, N.	2018	Circular Cities: Mapping Six Cities in Transition	academic article
Bolger, K., & Doyon, K.	2019	Circular cities: exploring local government strategies to facilitate a circular economy	academic article
Campbell-Johnston, K., ten Cate, J., Elfering-Petrovic, M., & Gupta J.	2019	City level circular transitions: Barriers and limits in Amsterdam, Utrecht and The Hague	academic article
Turcu, C. & Gillie, H.	2020	Governing the Circular Economy in the City: Local Planning Practice in London	academic article
Christensen, T. B.	2021	Towards a circular economy in cities: Exploring local modes of governance in the transition towards a circular economy in construction and textile recycling	academic article
Williams, J.	2021	Circular Cities: A Revolution in Urban Sustainability	academic article

Selection of literature and documents used in the document analysis

Author(s)	Year	Title	Type of literature
Circle Economy, TNO, & FABRIC	2016	Circular Amsterdam: A vision and action agenda for the city and metropolitan area.	project agenda
Circle Economy, Copper8, & City of Amsterdam	2018	Municipal Policy for the Circular Economy: Lessons learned from Amsterdam.	project report
City of Amsterdam, Circle Economy, & Copper8	2018	Amsterdam Circular: Evaluation and Action Perspectives.	project agenda
Prendeville, S., Cherim, E., & Bocken, N.	2018	Circular cities: Mapping six cities in transition	academic article
Circle Economy, & City of Amsterdam	2019	Building Blocks for the New Strategy: Amsterdam Circular 2020-2025.	project agenda
Campbell-Johnston, K., ten Cate, J., Elfering-Petrovic, M., & Gupta, J.	2019	City level circular transitions: Barriers and limits in Amsterdam, Utrecht and The Hague.	academic article
City of Amsterdam	2020	The Amsterdam Circular 2020-2025 Strategy.	project agenda
Williams, J.	2021	Circular Cities: A Revolution in Urban Sustainability	academic article

B. Coding Scheme

This appendix presents the used codebook with 16 codes that are divided into nine subgroups and three main groups. The framework is adapted from the Amsterdam Circular 2020-2025 Strategy (City of Amsterdam, 2020). The thesis used semi-closed coding process or mixed coding, as some codes (instruments) were deleted, modified, or added to the original typology. The additional codes are highlighted in a grey.

Code group	Code sub-group	Code	Explanation	Example
Regulatory & Legislative Instruments	Regulations	Strategy & objectives	Strategies and related objectives	"CE is written into the Amsterdam sustainability agenda, which also includes energy, climate-change resilience and air-quality. Since then, Amsterdam's Strategic Advisor for Sustainability stated that a full action program with 'circularity' as a key aspect was making the CE agenda a powerful one." (Prendeville et al., 2018)
		Spatial planning	Regulations related to spatial planning	"By safeguarding circular ambition in Spatial planning policy, all parties concerned are forced to realise them." (City of Amsterdam et al., 2018a)

Code group	Code sub-group	Code	Explanation	Example
Economic Instruments	Fiscal frameworks	Taxation	Positive and negative financial incentives	"Institutional instruments include market mechanisms (e.g., tax incentives for circular business practices)" (Campbell-Johnston et al., 2019)
	Direct financial support	Subsidies	Subsidies	"the way of financing is opportunistic: "we want to go where there is energy and give existing projects a boost and stimulate these by using our policy instruments such as through our sustainability fund"." (Prendeville et al., 2018)
		Circular procurement & infrastructure	Circular procurement activities	"Amsterdam has successfully employed public procurement as a powerful instrument that leverages the purchasing power of the municipality to create a market for circularity." (City of Amsterdam et al., 2018b)
		Tendering & land allocation	Tendering or land allocation activities	"Such features were particularly prevalent in Utrecht and Amsterdam as these cities are integrating CE practices in building tenders." (Campbell-Johnston et al., 2019)

Code group	Code sub-group	Code	Explanation	Example
Soft Instruments	Knowledge, advice & information	Research activities	Research policies oriented at gaining knowledge, advice and/or information	"the Dutch CE consultancy 'Circle Economy' plays a central role in the city's CE activities. It has supported benchmarking research on the city's physical resource flows (using its circular city mapping tool, city scan and city dashboard) giving policymakers information to manage the city's resource effectively" (Prendeville et al., 2018)
		Information (campaign)	Information sharing activities	"The municipality is developing a 'circular toolbox' with information about technical, financial, social, organisational and legal implementation issues and the associated risks." (City of Amsterdam, 2020)
		Capacity building	Capacity building activities oriented at gaining and/or providing knowledge, advice and/or information	"Local companies in the construction sector were invited to participate in a series of workshops to increase knowledge sharing, build competences and to create a circular value chain from demolition to construction. The workshops were organised by the municipality and as a result, a local green construction network was established covering companies involved in demolition, construction companies, architects and public authorities." (Christensen, 2021)
		Experimentation	Policies oriented at experimentation in order to gain knowledge, advice and/or information	"Numerous experiments are underway in the city. An experimental approach can be seen for instance in the legislative "free-zones" implemented in the decaying post-industrial area of Buiksloterham, where partners can experiment with waste collection and water sanitation approaches." (Prendeville et al., 2018)
	Collaboration platforms & infrastructure	Facilitation & coordination	Policies aimed at facilitating or coordinating collaborative actions and infrastructure	"In these processes, the municipality took an active role in establishing contacts with companies that could potentially use the demolished materials and acted as a facilitator." (Christensen, 2021)
		Data & information exchange platforms	Policies aimed at supporting the establishment and/or operation of	"The data platform of Amsterdam offers open access to a wide range of data, which citizens, businesses and research organisations can employ in implementing circular

			data and information exchange platforms	solutions." (City of Amsterdam et al., 2018b)
		Living labs	Policies aimed at supporting the establishment and/or operation of living labs	"This culture of experimentation, or 'urban living labs', brings together urban planning, academia, business, and the community to test urban innovations." (Bolger & Doyon, 2019)
	Governance	Institutional design	Policies aimed at modifying design of an institution	"Team leader of City Plans at the City of Melbourne commented on the challenge of implementation, 'from a delivery perspective and also internal council processes... it's very siloed in local government'" (Bolger & Doyon, 2019)
		PPP	Policies aimed at supporting the establishment and/or operation of public-private partnerships	"A partnership agreement between the municipality and the company was created to make sure that the bricks from the demolition demonstration projects would be treated and reused in the construction of new buildings." (Christensen, 2021)
		Lobbying	Any lobbying activity	"enabled LPAs to play a proactive role in 'lobbying' CE at the early stages of the planning process" (Turcu & Gillie, 2020)