Upscaling circularity in urban area development

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A qualitative study in ‘Circular Buiksloterham’

Upscaling circularity in urban area development

A qualitative study into circular strategies and the role of the municipality of Amsterdam in circular urban area development Buiksloterham.

By

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This thesis is written in fulfilment of the requirements for the degree of Master of Science (MSc) for the master program Construction, Management and Engineering (CME) at the Faculty of Civil Engineering & Geosciences at Delft University of Technology.

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Preface

I am very happy to finish this report successfully and therewith finalise the master Construction, Management and Engineering at Delft University of Technology.

Without the extensive help of my thesis committee, this thesis could not have been written. My first supervisor, Daan Schraven, who is an expert in the field of circularity in construction, guided me through this study. Els Leclercq, who has been of great value with all her expertise in management in the built environment, and her experiences with the city of Amsterdam. Furthermore, Annemiek Vos, who allowed me to conduct this research at the municipality of Amsterdam. She has taught me a lot about the municipal organisation, its challenges, difficulties but overall its opportunities. And last but not least, professor Marcel Hertogh, who guided me by sharing his knowledge, experiences and advises. I want to express my gratitude to all of them.

With appreciation,
Heleen Nicky Joustra
Amsterdam, June 2020

Executive summary

The city of Amsterdam is following the ambitions of the National Government to operate a fully circular economy in 2050. To do so, circular urban area development (UAD) must become standard. As a start, Buiksloterham is declared a circular UAD project, via a manifesto, by over twenty participating parties including the municipality. This master thesis aims to give recommendations about upscaling circularity in UAD. The research question that is answered is: *How can the Municipality of Amsterdam scale up circular urban area development by learning from projects with high circular ambitions in Buiksloterham?*

The theory study discusses urban area development, sustainable development and circular economy, to provide an overarching framework for circularity in UAD. UAD appears to be very complex. It operates at different scales and between two physical components. It includes numerous stakeholders and is developed through four phases. With this knowledge, sustainable development and circular economy are studied for strategies, that are relevant in UAD. The strategies are found in similarities between sustainability and the circular economy by the research of Geissdoerfer et al. (2017), in a study in the three core concepts of CE by Kirchherr et al. (2017), and other prominent researchers of both theories. The result is a framework of circular strategies that can indicate circularity in the built environment (table 1).

Table 1: Theory strategies circularity in UAD

		Aspect	Strategy	Source
1.		**Energy**	Closed energy system	(EMF, 2015; van Bueren, 2012; Clift, 1998)
2.		**Energy**	Use of sustainable energy resources	(Braungart and Mcdonough, 2002; EMF, 2015)
3.		**Materials**	Closed material system, waste as a resource	(EMF, 2015; van Bueren, 2012; Pauli, 2010; Sassi, 2008; Braungart&Mcdonough, 2002)
4.		**Materials**	High quality reuse of materials	(Kirchherr et al, 2017; Sihvonen and Ritola, 2015; van Buren et al., 2016; Potting et al., 2017; Cramer, 2017)
5.		**Water**	Closed water system	(EMF, 2015; van Bueren, 2012; Clift 1998)
6.		**Economy**	Service economy	(EMF, 2015; Geissdoerfer et al, 2017; Stahel 1976)
7.		**Economy**	Businessmodel innovation as key for industry transformation	(EMF, 2015; Geissdoerfer et al., 2017)
8.		**Economy**	Use of potential cost, risk and diversification for value creation	(Geissdoerfer et al., 2017)
9.		**Economy**	Central role is in private business due to resources and capabilities	(Geissdoerfer et al., 2017)
10.		**Nature**	Non-economic building principles inspired by nature	(Braungart and Mcdonough, 2002; EMF, 2015)

11.	**Digital technology**	Use of digital technology for virtualisation	(EMF, 2015; Geissdoerfer et al., 2017)
12.	**Design**	Design for disassembly and flexibility	(Habraken, 2007; EMF, 2015; Kirchherr et al., 2017)
13.	**Design**	Coexisting pathways of development	(Geissdoerfer et al., 2017)
14.	**Scales**	Operate circular principles at al scales	(Geissdoerfer et al., 2017; Van Bueren, 2018; Pomponi and Moncaster, 2018)
15.	**Stakeholders**	Intra and intergenerational commitments	(Geissdoerfer et al., 2017)
16.	**Stakeholders**	Cooperation of different stakeholders	(Geissdoerfer et al., 2017)
17.	**Regulation and incentives**	Regulation and incentives as core implementation tools	(Geissdoerfer et al., 2017)
18.	**Research**	Make use of a multi- and interdisciplinary research field	(Geissdoerfer et al., 2017)

This framework is used to indicate, study and reflect upon circularity in BSH. The used method is a process research. In process research, events are analysed to examine change and development over time. In Buiksloterham, the events are divided into process and project events. The lists of events together give a complete overview of the development in Buiksloterham. Four of the project events are chosen for an in-depth case study. The data for the in-depth study is gathered by a project analysis, a document analysis and qualitative interviews. Two sets of interviews are conducted, one set representing the viewpoint of the developers (the term used for architects, project developers and inhabitants merged), and the other set representing the viewpoint of the municipality.

The four cases that are studied are De Ceuvel, SchoonSchip, Bosrankstraat and Patch22. It is found that upscaling circularity as municipality covers two main issues. A policy and management issue on how the municipality should interact, and a practical issue on the development of circular strategies in projects with a high ambition of circularity.

The municipality covers different roles during the realisation of the building projects. This can be divided into public and private roles. The private role is, among other things, about land issue, prices and leasehold arrangements. The public role includes facilitating, initiating and controlling roles. Developers do not make a clear distinction between the different roles the municipality holds. A lot of issues appear to be linked to the department of land affairs, executing the private role of the municipality. Problems with the policy and management issue of the municipality are translated to barriers.

With the use of the framework, the total of circular strategies in the real estate in Buiksloterham is found. The strategies that in this research appear ready for upscaling are: project ‘Nieuwe Sanitatie’ with vacuum toilets, wood as primary construction material, MAAS-project, cleaning

of polluted soil by plants, building on water, flexible designs, use of multi and interdisciplinary research fields. During the implementation of circularity, developers ran into more barriers.

The total of barriers that developers experienced regarding circular strategies and the role of the municipality are discussed with two circularity advisors of the municipality. They reflect upon the barriers from the municipalities point of view. After analysing both points of views, the following table gives a brief overview of the possible actions for the municipality.

Table 2: Barriers and actions

Barrier	Action for the municipality
1. Apartment rights	The department of land affairs is responsible for the leasehold arrangement that include the apartment rights. They must analyse the leasehold arrangement for flexible apartment rights and work/living structures. If there appears to be a problem with the current leasehold, changes must be made.
2. Land value calculation	A customised calculation must be done if developers prove that the only option for implementing their circular strategy leads to higher foundation costs. Analyse comparable projects as Patch22 and TopUp in Buiksloterham and other areas. Take the loss of face that Patch22 creates for the municipality must be taken seriously.
3. Local drink water permits	The quality and grants for drinking water are the responsibility of the National Government (NG). The municipality can use their influence when they have enough resources to prioritise this barrier.
4. Integral approach for measurement of circularity	Aim for more customised measurement. Keep evolving the 'menu scorecard' system by reflecting on completed projects. Prioritise an integrated approach.
5. Building decree	The building decree is the responsibility of the NG, but the municipality has input opportunities about this topic. Specific barriers regarding the building decree can be presented in those input moments.
6. Legal jurisdiction implementing circularity	Stimulate the attraction of circular pioneers in the area where possible. Specific legal jurisdictions can be added as performance indicators in tenders and/or subsidy granting. Work towards a more binding version of the manifesto
7. Land price increasing	Research must be conducted in the possibility to keep the land price low for circular projects. The risks of taking on a redevelopment project without a tender agreement must be made clearer for developers.
8. Lack of knowledge by contractors	Inform and facilitate where possible. If new circular building methods become standard, the market has to move and learn to keep up. Leave room for bottom-up initiatives.
9. Contact with the municipality	Make it clearer for developers were to address issues regarding circularity. Inform developers about the different departments of the municipality. fill this information gap.

10. Sinking of the excrement boat	Briefly analyse the incident. Make responsibilities of ownership and maintenance clear.
11. Waste separation	A recalibration of the central waste collection in the city of Amsterdam is needed. As Buiksloterham is a pioneer, the project team can put pressure on the city. In line with the ambitions of the municipality, the waste separation problem must become a priority city-wide.

In addition to responding to the barriers, the municipality should take various actions to upscale circularity in UAD. The municipality should aim for a system change in Buiksloterham by taking the current strategies to a larger scale. For assessing the strategies in tenders and or with subsidy schemes, there should be an integrated approach as much as possible. Besides, the municipality should fill three information gaps. The first is about their controlling role. The developers wish for more control in new projects, whereas the municipality says they control adequately. The second is about the ambitions of the department of land affairs. A clear explanation of the different roles and objectives of the departments can help. Third, better imaging of the plans is necessary, as there is a cynical view between developers about the current ambitions of the municipality in BSH. Municipal projects should be easily accessible for inhabitants.

Buiksloterham involves many professionals in circular development. They have a natural motivation for a circular neighbourhood, which they have proven in the realisation of high circular ambitions. Engaging them in the plans will have a positive effect on upscaling circularity. They have a lot of experience with procedures, plans and the methods of the municipality. Their lessons learned can be of great value for new developments.

Further research must point out if the framework of circular strategies is suited on the larger scale and within projects in the public space. When additional research in the public space is executed, a more elaborate answer to the research question can be given.

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List of abbreviations

BSH	Buiksloterham
C2C	Cradle-to-cradle
CE	Circular Economy
CPO	Collective Private Commissioning
EIA	Environmental Impact Assessment
EMF	Ellen MacArthur Foundation
EPC	Energy Performance Indicator
GFA	Gross Floor Area
GWW	Public infrastructure (Dutch: Grond, weg en water)
NG	National Government
SD	Sustainable Development
SEA	Strategic Environmental Assessment
UAD	Urban Area Development

Part I - Research Introduction

Chapter 1 – Introduction

Source: Delva Landscape Architects Urbanism

1. Introduction

“In 2050, the Dutch economy will be circular” (Rijksoverheid, 2016). The Dutch government has stated its ambitions for a completely circular economy by 2050, with a reduction of 50% in virgin material use (fossils, minerals and metals) in 2030. These goals are set and signed in the Paris agreement in 2015 and follow up the Sustainable Development Goals of the United Nations. It emphasizes a movement from a linear to a circular economy, which includes a fundamental change from the standard linear economy (take, make, use, dispose) where we produce from the cradle to the grave, to a production from cradle to cradle (Kirchherr et al. 2017; Millar, Mclaughlin, and Börger 2019).

It is not surprising that the construction industry is one of the five sectors the Dutch government lays focus on. Research points out that the built environment is responsible for 36% of the national CO2 emissions, 50% of the national material usage and 40% of the total energy consumption (Schoolderman et al., 2014). Besides, almost 40% of all the waste in the Netherlands is related to construction and demolition waste (Schoolderman et al., 2014). During the construction phase, construction companies and the supply chain of the built environment use-up a substantial amount of natural resources to produce their building components (Mulders, 2013). Furthermore, 80% of the embodied energy in buildings is a result of the production processes of materials (Hawken, Lovins & Hunter, 2013). This heightened awareness of environmental pollution, natural resource depletion and accompanying social problems in the construction sector asks for changes.

The city of Amsterdam is in constant transformation with everyday work in the construction industry. A big part of the construction industry is the development of urban areas. In 2019 over twenty-one urban area projects were in construction (Gemeente Amsterdam, 2019). As the largest municipality of the Netherlands, they strive for implementation of a circular economy in line with the ambitions of the Dutch government. This means these ambitions must be translated into forms of strategies and plans for the construction industry. As a start, the municipality, together with over twenty parties contributing to the development of the area, declared the construction of urban area Buiksloterham (BSH) as a ‘circular’ urban area development.

Buiksloterham

Buiksloterham is part of the redevelopment of the Noordelijke IJ-oever in Amsterdam. In the 19th century, it was an industrial area with large shipping and industry plants. The traces of those industries are still present in the soil and surrounding. Where the connection of this area with the city improves, the housing shortage in the city becomes a more significant problem. Therefore, the municipality of Amsterdam decided officially in 2009 to redevelop BSH into a work and living area. Due to the economic crises, the redevelopment started slowly. Today the development is in full swing, and the construction projects are expected to last until 2030. In 2015, over twenty actors and parties signed a manifest ‘circular Buiksloterham’. Although all parties agreed on focussing on circularity, there is no overarching sustainability master plan or

guideline (Metabolic, 2014). Before the manifesto was signed, various projects were executed following sustainability criteria. The municipality and the involved parties are following the motto “learning by doing”. BSH is planned to be a leader in its kind and therefore, the perfect case study in a search for circularity in urban area development.

1.1 Problem statement

1.1.1 Knowledge gap

A circular area development project includes implementing circular strategies as one of the key concepts from start to finish. Different stakeholders involved in the project have to learn about the new strategies and should be aligned on realising the same ambitions. But what are circular strategies? And what is a circular urban area development? The term ‘circular’ is distracted from our new vision on the economy, the circular economy. The term is highly discussed and researched (Kirchherr et al., 2017) and is mainly about an economic society that aims for continual use of resources. Remarkable is the difference in definition by researchers in different fields. Although the Circular Economy theories are increasingly and more and more discussed, circularity in the construction industry, within particular urban area development (UAD), is yet little examined in the literature. No framework of strategies has been found that can be used to define a circular urban area project or to recognise circularity in a built environment.

According to various researches the number of failed initiatives of sustainable [circular] urban area development on a global basis considerably exceeds examples of good practice available (WRI 2003; MEA 2005; Miller et al. 2008). Adams et al. (2017) aim for industry-wide awareness of the CE concept, but also note that most CE solutions are found in the last stage of the project, focussed on waste management (Adams et al. 2017). Especially for UAD projects, circular must mean a lot more than waste management. Besides the difficulties of the meaning, Castelein (2018) claims that there is no incentive for parties in the construction sector to change towards a circular economy. When implementing CE in the built environment, there are barriers of financial, sectoral, cultural and regulatory nature (Hart et al. 2019). What those researchers have in common is that they all have not found an obvious way to implement circular strategies in UAD.

1.1.2 Relevance in practice

To meet the ambitions of the Municipality of Amsterdam for a fully circular economy in 2050, they have to scale up circular urban area developments. As stated in the introduction, BSH is planned to be a leader and pioneer in its kind. It is an urban area development where the endless theories on sustainable development and circular economy are turned into practice, even though there is no set example for circular UAD in theory or practice yet. As BSH is a designated area for circular experimenting, it is essential to evaluate and learn from barriers in BSH. Amsterdam is the capital of the Netherlands; it functions as an example and is a large city able to make a significant difference. When projects are visible and tangible, they become feasible for the broader public. Therefore, it is essential to find successful strategies of circularity in Buiksloterham, to set an example for Amsterdam (and the rest of the Netherlands). As the municipality plays a significant role in urban area development, learning from BSH can help improving removing barriers. If their ambition is to have a fully circular economy in 2050, they have to know how they can be involved best.

1.1.3 Research objective

This research aims to analyse how the municipality of Amsterdam can scale up circular urban area development. This concerns two main issues. A practical issue, regarding the question of what a circular UAD entails. What is circular UAD? What strategies need to be implemented to realise circular UAD and what barriers pop up when doing. Besides, it entails a policy and management issue regarding the role of the municipality. How can they operate best to realise circular UAD? Both questions can be answered by learning from Buiksloterham, an area with completed real estate projects with high circular ambitions. Before the case study in Buiksloterham, the gap in the literature on the meaning of circular urban area development must be analysed. The case study can eventually provide feedback on the gap in the literature.

These considerations have resulted in the following research question:
How can the Municipality of Amsterdam scale up circular urban area development by learning from projects with high circular ambitions in Buiksloterham?

1.1.4 Sub-questions

Three subquestions can be formulated to answer the main question. The questions are as followed:

1. *What is circular urban area development, and how can it be defined in practice according to the current literature studies?*
2. *How to analyse a real-time urban area development project for circular strategies and the role of the municipality?*
3. *How are circular projects developed in Buiksloterham, and what role does the municipality play in the development?*
4. *What do the cases of Buiksloterham provide as learnings for circular urban area development for the current literature and the city of Amsterdam?*

1.1.5 Research demarcation and scope

There are three points of attention identified related to the scope of this research. First of all, the study is focussed on urban area development (Dutch: gebiedsontwikkeling) in the Netherlands. UAD is generally heavily embedded in local legislation and procedures. (Van ‘t Verlaat, 2008). Every country, province and municipality have different plans, powers and procedures. The forms of cooperation, business models and legal documents variate across countries (Stumpel and Heurkens, 2014). This research is scoped to the Dutch UAD. It will be irrelevant to compare all those different variables in different countries while searching for new deltas by comparing circular UAD to normal UAD in the Netherlands. Also, the research is conducted at the engineering office (Ingenieursbureau) of the municipality of Amsterdam. They own 1/3 of the ground in the area Buiksloterham. While analysing the process of a UAD, the standard method for UAD projects that the municipality uses is also taken into account.

This research focuses on one urban area. Urban area development is very complicated. At the construction level, it can be divided into real estate projects and infrastructure (Dutch: grond, weg en water (GWW)) projects. The design of the infrastructure is partly planned, but not yet realised. When studying implemented circular strategies, a study in the GWW in Buiksloterham would be of no benefit. Therefore the scope of this research is real-estate projects.

During the realisation of urban area development, a lot of stakeholders are involved. This research focusses on the experiences in circular development from two sides. Bottom-up from project developers, architects and inhabitants, collectively named as 'the developers' side'. And top-down from without the municipality. Other experiences from other parties (e.g utility parties) in circular development are excluded.

1.1.6 Hypothesis

The current expectation is that Buiksloterham is an area in which pioneering of innovative and novel ideas are encouraged. It will have certain new circular strategies that other UADs in Amsterdam have not implemented (yet). There have been sustainable area projects in Amsterdam (Westertoren area), focussed on biodiversity and low emissions, but those projects are significantly smaller than Buiksloterham. The expectation is that in literature, the strategies on executing 'circular urban area development' are little discussed, or only on a high theoretical level. Searching for circular strategies in Buiksloterham will likely be close to searching for sustainable development. Because Buiksloterham is an area that attracts pioneers in the field of circularity, it is expected there will be many barriers. The municipality is known as a large and bureaucratic body, and since the law and regulation are not standardly based on circular or sustainable development, difficulties will likely have appeared. It is expected that the municipality can learn from the events in Buiksloterham and their role within.

1.2 Research strategy

The most significant decision for the research design is what kind of approach will be taken (Verschuren & Doorewaard, 2010). The research strategy will include the coherent body of decisions concerning how the research will be carried out. The process steps of Verschuren & Doorewaard (2010) are followed for this research design.

The first key decision is about going for a breadth or depth research. In short, this means choosing between going for a broad overview of the discipline or a thorough investigation of all the aspects of a phenomenon spread out over a span of time and space. The second key decision is about going for a quantitative (findings compiled in tables, charts, calculations) or qualitative approach (interpreting approach). The last and third key decision is about the data. This can be done by doing research in the field and making a judgement on analysing self-find data, called empirical research, or by researching existing literature and data from others named desk research.

Table 3 gives an overview of these process key decisions for this research. Because this research is twofold of theory-oriented and practice-oriented research, the key decisions are made for both.

Table 3: Key decisions research strategy

		Theory		*Practice*	
		Choice	Clarification	Choice	Clarification
1.	*Breadth or in-depth*	Breadth research	Analysing the literary content available on Dutch UAD, sustainable development and circular economy.	In-depth	Learning from BSH will typically be done by thorough investigation in the process and projects in the area.

2.	*Quantitative or Qualitative*	Qualitative	The literature will be interpreted by designing a framework with strategies for circular UAD	Qualitative	Analysing the outcomes will be done by an interpreting approach. Results will focus on developing new insights and theories.
3.	*Empirical or Desk research*	Desk research	Existing literature will be researched, and data of other studies will be interpreted for this research.	Empirical research	The data will be gathered in the field (BSH) and results will be analysed by self-judgement.

The combination of these key decisions has resulted in a grounded theory approach for the theoretical background and a process and case study approach in the practice-oriented research.

1.2.1 PART II - Initial research

The first two sub-questions will be answered in the initial research. The first one is focussed on deriving knowledge from the theory. A theory study is a form of collecting or exploring data from open scientific sources. For this research, the theoretical background is of great importance. The aim is to find out what in literature is written about circular UAD. The analytic framework that will be designed is used to identify and recognise circular strategies in practice.

The data to realise the proposed framework of circular strategies for UAD will be gathered through three concepts in literature; Urban Area Development (UAD) process, Sustainable Development (SD) and Circular Economy (CE). See figure 1. The sub-question that will be answered is: What possible circular strategies for urban area development can be found in literature?

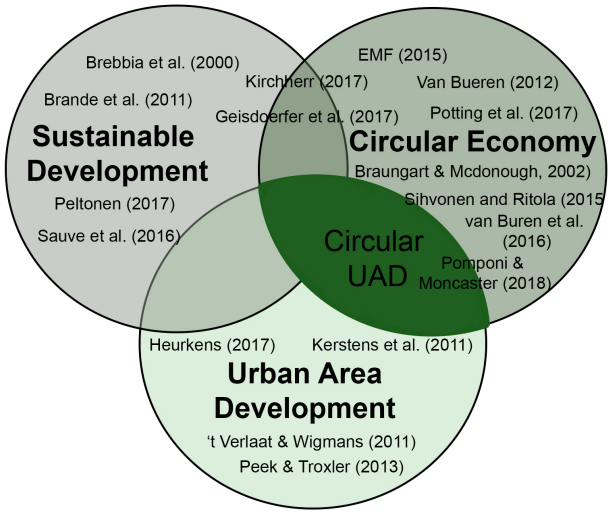


Figure 1: Literature study overview of researchers

The second sub-question is focussed on how to answer the main question, by deciding on a refined methodology for the process and case studies. The question is: *How to analyse a real-time urban area development project for circular strategies and the role of the municipality?* This answer is given in chapter 3, the methodology. The two questions together form the research preparation and finding answers is done through desk research.

1.2.2 PART III - Case study research

For this study, the unique case of UAD Buiksloterham will be researched. It is a one of its kind in the field of UAD projects and executing a study on the case is a great opportunity for research into circular economy in the built environment. It is an ongoing case and because there are already circular projects executed, the municipality can retrieve lessons learned for scaling up circularity. A process theory research is used to study events in Buiksloterham.

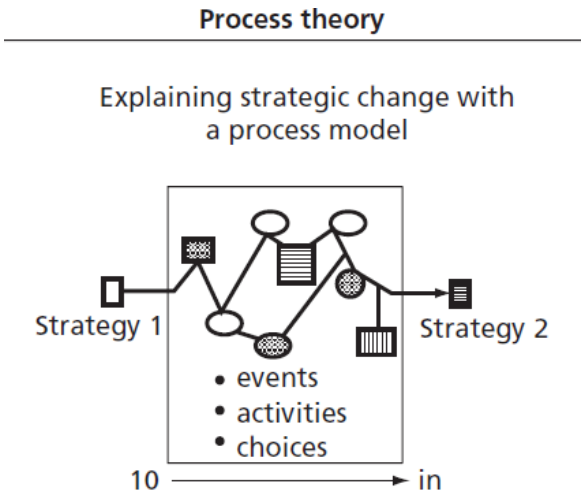


Figure 2: Process theory (Van der Ven, 2007)

The events, activities and choices are derived from a document study and a participation/case study. Strategy 1 is the start of an urban area development, strategy 2 is the desired outcome to realise a circular urban area development. The process research also makes uses of the case study theory, including qualitative interviews.

This research part answers the question: *How are circular projects developed in Buiksloterham and what role does the municipality play in the development?* To answer this question, in the case study the role of the municipality and the implementation of circular strategies is analysed. Part III is divided into three chapters. In Chapter 4, the process of Buiksloterham is studied, and four subcases are introduced. Chapter 5 discusses the development of circular strategies and the barriers that appeared, from both the viewpoint of the developers and the municipality. Chapter 6 reflects on the results and findings of the case studies.

1.2.3 PART IV - Research review

The research review includes a discussion, conclusion and recommendation section. The discussion paragraph discusses the findings with the current practice of the municipality and with the literature. The discussion aims to answer the question: *What do the cases of Buiksloterham provide as learnings for circular urban area development?*

The conclusion section answers the sub-questions and the main question. Lastly, recommendations will be given based on the outcomes of the case studies. It includes suggestions for further research and the municipality.

1.2.4 Thesis structure

Part I: Research introduction

Chapter	Aim	Main Question
1. Introduction	Introduction to the research	*How can the Municipality of Amsterdam scale up circular urban area development by learning from projects with high circular ambitions in Buiksloterham?*

Part II: Initial research

Chapter	Aim	Research question
2. Theory study	Analysing and understanding the process of UAD and the circular strategies that define circular UAD	What is circular urban area development and how can it be defined in practice according to the current literature studies?
3. Methodology	Designing and explaining the research strategy to answer the main quetion.	How to analyse a real-time urban area development for circular strategies and the role of the municipality?

Part III: Case study research

Chapter	Aim	Research question
4. Case study 4.1 Buiksloterham 4.2 Sub-cases	Thorough analysation of the urban area development Buiksloterham	
5. Findings	Present findings of interviews and document study about the practical aims of circular strategies and the role of the municipality in achieving this.	How are circular projects in Buiksloterham developed and what practical aims of circular strategy can be found in the area?
6. Reflection	Reflecting on the case studies	

Part IV: Research review

Chapter	Aim	Research question
7. Discussion 7.1 Literature 7.2 Amsterdam	Discusses findings from the case study research in relation to the literature study and to the current policy and situation in Amsterdam	What do the cases of Buiksloterham provide as learnings for circular urban area development in literature and for the city of Amsterdam?
8. Conclusion	Answering the main research question	*How can the Municipality of Amsterdam scale up circular urban area development by learning from projects with high circular ambitions in Buiksloterham?*
9. Reccomendations 9.1 Municipality 9.2 Further research	Reccomendation based on the case studies for the municipality and for further research	

Figure 3: Thesis structure (own ill.)

Part II - Initial Research

Chapter 2 – Theory study

Chapter 3 - Methodology

2. Theoretical background

The overarching goal of providing a theoretical background is to define circular UAD. This chapter will provide the background information on this fundamental concept. First, the process of UAD will be elaborated on. Second, the theories of sustainable development and circular economy are analysed, to find circular strategies applicable to UAD. The circular strategies for UAD derived from various studies in literature form an analytic framework.

2.1 Urban Area Development

Urban area development (UAD) (Dutch: Gebiedsontwikkeling) has multiple definitions in the literature. Daamen (2010) et al. defines UAD as a system of concrete material interventions within a geographically defined area. Van 't Verlaat (2008) describes the process of UAD as "active intervention by governments and other organisations on the development of urban areas." De Zeeuw (2007) states: "UAD is the art of connecting functions, disciplines, parties, interests and money flows, with a view to the (re) development of an area." In this research, the definition based on the above studies will be followed.

Urban area development is the process of physical adaptation of a specific location to socio-economic and spatial needs, by different parties using different instruments and activities to realise an integrated functioning area (Heurkens, 2016).

The process of physical adaptation brings extensive changes in the area. It likely consists of the demolitions of old buildings and the construction of new ones, a rezoning of the land-use plan and the creation of new roads. The content of the UAD is about developing an area with spatial composition wherein different uses (residential, business, social housing, etc.) live in harmony (Franzen et al., 2011). It is mainly about the redevelopment of existing urban areas. Not that long ago, urban area development was established with extensive governmental involvement. They influenced and decided upon the preparation of the land and the implementation of spatial planning (Louw et al., 2003). The public actors had a lot of power. Above that, the decision making was focussed on a city as a whole, not specific in urban areas. However, around 2000, the power started to shift towards private actors. Demand-driven development replaced standard supply-driven construction (Heurkens, 2012). This decentralisation has made the management of UAD projects increasingly complex (van Bueren et al., 2016).

The totality of different real estate projects in combination with the development of infrastructural and public space is a complex and significant process. Each of these subprojects needs cooperation and sufficient knowledge on architecture, planning, construction, finance and communication to be a successful contribution to the district, but also as an individual project (Van Hoek & Wigmans, 2011). This chapter is focussed on which actors, processes and phases contribute to the development of an urban area.

2.1.1 Scales in the built environment

The built environment can be divided in different dimensions by using different physical scales. The scales are, according to van Bueren (2018) and Heurkens (2018): materials, components, product, building, urban area, city and natural environment.

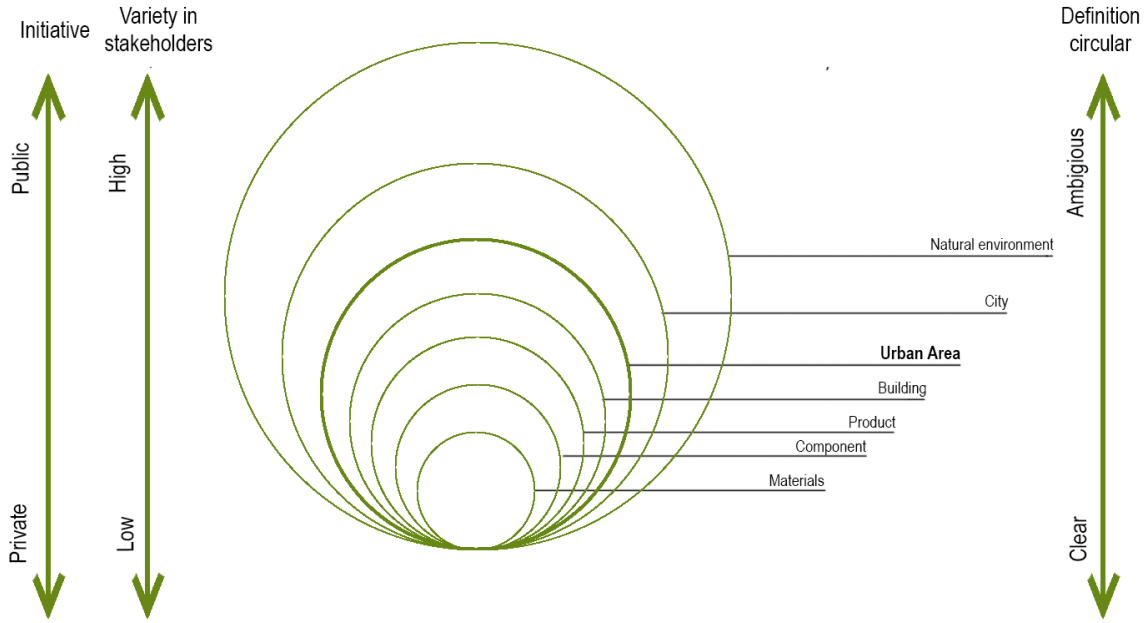


Figure 4: Scales of the built environment with circular perspective (Own ill. Adapted from Van Bueren, 2018; Pomponi & Moncaster, 2018)

The scales are interrelated, as operating on the urban area scale includes buildings, components and materials, but they have different characteristics. The larger the scale, the more stakeholders involved, increasing the complexity. Furthermore, the smaller scales are mainly private initiatives, whereas larger scales are developed with public actions. The urban area scale lies in the middle, which means it has public and private initiatives. Van Bueren (2018) states in her presentation that also the term 'circular' gets more complex as the scale gets larger, but there is a lack of sufficient research in the circular economy within the scales.

More familiar scales are the micro, meso, macro scales. The building scales in figure 4 are an expansion of those scales, wherein micro is the component scale, meso the building and macro the city scale (Pomponi & Moncaster, 2017). According to Pomponi & Moncaster (2017), there is a lack of research in the urban area scale [meso level]. They say the main focus on circular principles is in the component [micro] and building [macro] scales. The distinction in these scales is according to them necessary to implement circular policies. (Pomponi & Moncaster, 2017).

The urban area has two physical components: public space and real estate. Real estate includes both buildings and parcels. Public space consists of the ground, waterways and streets (Dutch: GWW) and the underground infrastructure (cables and pipes) (Franzen et al., 2011). These could be placed on the building scale and the urban area scale.

2.1.2 Product versus process

Executing UAD can be divided into two deliverables, the product and the process. The process is used to create the product: physical objects in the built environment. The process is a series of steps that are followed throughout all the phases of a project. Process management in terms of UAD involves thorough research, ensuring active involvement and support and is to design a framework for achieving an effective decision-making process (Franzen, 2011). The process brings different interests and stakeholders together by assessing the feasibility of shared ambitions. It involves close relationships between the people. In development in the built environment, process decisions are often captured in policy documents. The product is focussed on the outcome and realisation; it is about the tangible assets that are actually built. Both deliverables run parallel and are highly integrated.

2.1.3 Phases

The process of an UAD project is traditionally divided into different phases. Literature mainly describes four successive phases (‘t Verlaat and Wigmans, 2011); (Peek and Troxler, 2013); (Heurkens, 2017). These phases show the same sequence that is found in real estate or project development, and the two are interlinked (Peek and Troxler, 2013). The phases are rather iterative than linear and end with a review process, where there is agreed on a decision to continue and how. Although these phases are widely used in literature to describe an UAD, it is important to note that due to the different political, cultural and geographical context every UAD process can be different.

The following literature describes the phases in Dutch urban area development. Whereas the names of the categorization are sometimes a little different, the meaning is rather similar. The standard UAD of Amsterdam is also analysed and taken into account. The main thing that points out is that Phase 3 according to the Amsterdam standard is the design phase, whereas literature includes the design within the realisation phase. Also, maintenance is not pointed out as a phase. This has to do with the organisational structure inside the Municipality of Amsterdam. Different offices are responsible for different phases, after the realisation ‘Stadswerken’ and ‘Verkeer & Openbare Ruimte’ is responsible for the small and large maintenance.

Table 4: Researchers and their phases of UAD

Research	Phase 1	Phase 2	Phase 3	Phase 4
‘t Verlaat & Wigmans (2011)	Initiative	Planning	Realisation	Maintenance
Peek & Troxler (2013)	Initiative	Feasibility	Realisation	Management
Heurkens (2017)	Initiative	Design & Feasibility	Realisation	Operation
Kerstens, Wolting, ter Bekke, Bregman (2011)	Initiative	Feasibility	Realisation	Maintenance
Amsterdam	Explorative	Feasibility	Design	Realisation

1. Initiative

UAD projects generally start with an initiative. This first initiative can originate in both the private (market demand) and the public sectors (policy decisions) (’t Verlaat & Wigmans, 2011), and

is often based on a problem. A scope will be designed for the designated area with a rough concept of what the project should look like. Research into political and social context is very important, together with a clear statement of reasons, the formulated task, the parties concerned and the expected risks and issues (Franzen et al. 2011). The phase ends with a mutually formulated ambition and master plan (’t Verlaat & Wigmans, 2011); (Kerstens et al., 2011). After this phase it is clear that there is no better alternative and the project has sufficient support. The scope, ambition and masterplan are written down in a ‘Principenota- en besluit’.

Next to the delivery of the ‘Principenota- en besluit’, the legal document that is formulated and signed in this stage is the Strategic Environmental Assessment (SEA) (Chao-Duivis, Hobma en Schutte-Postma, 2011).

2. Feasibility

In this phase, all sectorial and facet-related aspects are integrated into the plan (’t Verlaat & Wigmans, 2011). It is the most intense and complex phase (Kerstens et al. 2011), that ends with a complete formulated project plan. This phase has three sub phases; definition, design and preparation, and is also referred to as the planning phase. The subphases run together but act separate and iteratively. Preparation includes defining the program of requirements. The ideas and plans are developed with multiple actors, interaction and tasks. Risk will be distributed between relevant parties and in the end of this phase, contracts and agreements are made with participating parties. A study of how the project must be implemented without damage to the environment is obligated in this phase; it is a follow up of the SEA, the Environmental Impact Assessment (EIA). This is the basis for the environmental permit for the land use plan. A financial and urban master plan is used for the new land-use plan.

The deliverables/legal agreements of this phase are: a municipal land-use plan, contracts with parties and an Environmental Impact Assessment (EIA) (Chao-Duivis, Hobma and Schutte-Postma, 2011).

3. Realisation

The realisation phase is about the physical realisation of the real estate and infrastructure as a whole by specific construction and design plans for each geographical subdivision. The realisation will follow up the planning documents and land use plan as decided on in the feasibility phase, with a definitive plan and design for dividing the land into blocks (dutch: kavels) and public space (dutch: GWW). New parties like builders and constructors are involved. It is a complex phase where many problems can arise (‘t Verlaat & Wigmans, 2011). Important tasks for the client (municipality) are: write tenders, clean polluted soil, set up building contracts and supervise building site (Chao-Duivis, Hobma and Schutte-Postma, 2011). The realisation phase likely takes many years. The municipality can manage its ambitions through tender criteria and requirements.

The deliverables/legal agreements of this phase are: Construction contracts (based on tender criteria) and permits. (Chao-Duivis, Hobma and Schutte-Postma, 2011).

4. Operation & maintenance

In this phase, according to the literature, the UAD ends (Kerstens et al. 2011). Sub projects are assigned to the end users (owners, investors, municipality, private parties). It is about operating and maintaining the infrastructure and about building exploitation.

Figure 5 gives a schematic overview of the phases and associated documents. The phases and documents will be used to link circular characteristics derived in the following chapters to the process of UAD.

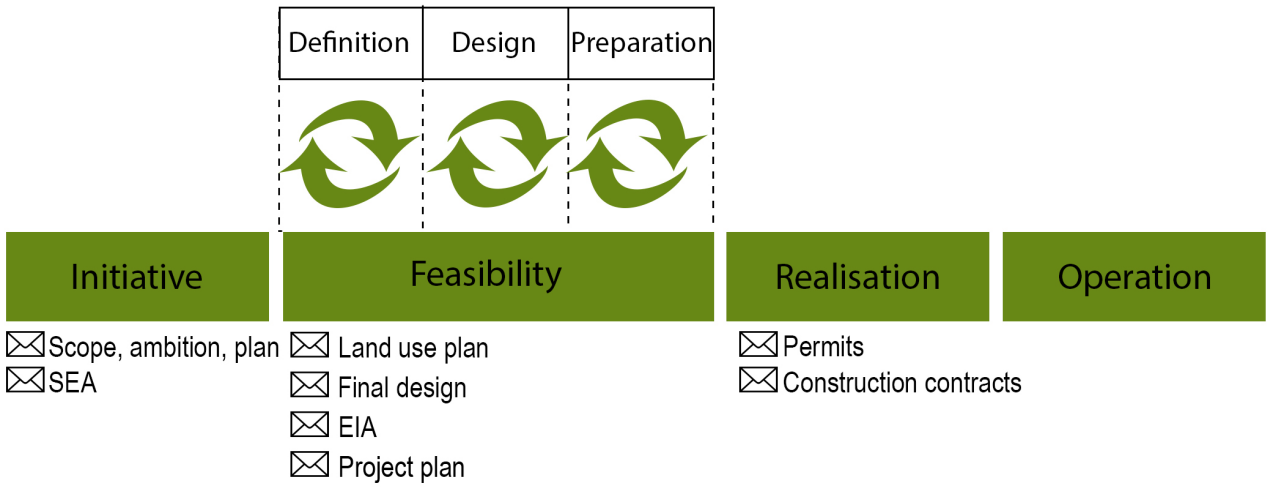


Figure 5: Schematic overview phases and documents UAD (Own ill. adapted from Kerstens et al. 2011)

All the researchers agree that there is more opportunity to make changes to the project in the beginning phases (initiative and feasibility). From the realisation phase on, the impact of the changes reduces, and the costs increases exponentially.

2.1.4 Reflection

UAD is very complex. It operates between the meso and macro level, at the urban area scale (van Bueren, 2012). It can be divided into two physical components: public space (GWW and underground infrastructure) and real estate (buildings and parcels). It has characteristics of both public and private initiatives and a large variety of stakeholders. Developing an urban area focuses on product and process, both highly integrated. The development process is iterative and shaped through stakeholder interaction. While the product is expressed through its physical elements, the process is expressed in documents and plans. This suggests when searching for new circular strategies in a UAD, they can be found in the built environment by research into the built artefacts.

A UAD goes through four phases. Every phase has key documents (figure 5). The implementation of innovations and/or circular strategies are probably found in the beginning phases, as in building processes the cost increase exponentially the later the changes.

Current literature typically does not include a redevelopment phase. After maintenance and operation, there is room for a post-phase that includes redevelopment, disassembly, reclassification or/and reuse of materials, building parts and infrastructure. This phase is about long-term ambitions and can consist of various circular strategies.

2.2 Circular Economy

Our development and prosperity are currently based on fossil fuels and finite mineral resources such as metals, phosphate fertilisers, rare gases, etc. We build and develop in a linear economy. At the end of the lifecycle, building materials and fossil fuels become waste. There is consensus about the need for a more sustainable way of dealing with the environment and materials. This is where the recent terms 'circularity' and 'circular economy (CE)' come forward. This term and its difference with a current linear economy are schematically pictured in figure 6.

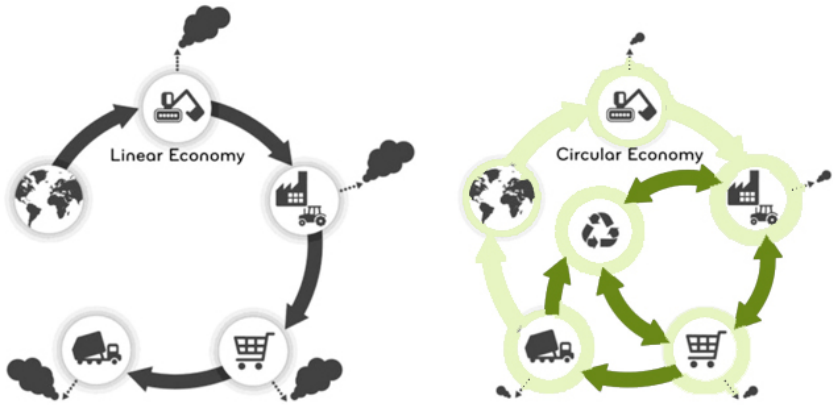


Figure 6: Sauvé et al. (2016). Circular vs Linear Economy

CE is a new and highly discussed concept. This becomes evident in the research of Kirchherr et al. (2017), who point out that 73% of the 114 definitions of the circular economy are from the past five years. Also, the higher governments just started to discuss the concept; for instance, in 2015, the European Circular Economy Package is formulated. This is followed up by the Chinese Circular Economy Promotion Law in 2016, and A New Circular Economy Action Plan by the EU in 2020. This part of the literature study dives into the CE to find circular strategies for the built environment. The most prominent and applicable studies are analysed on what is pointed out that can contribute to the realisation of a 'circular' UAD. The subquestion that will be answered is: What are possible circular strategies for an urban area development process?

2.2.1 Relation SD and CE

Around 1987, sustainable development started to gain attention on the political agenda. Sustainability is about integrating economic, environmental and social objectives as a basis for environmental policy (Gibbs, 2008). The most commonly accepted definition for sustainability is defined in the Brundtland Report (WCED, 1987, p. 37) as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This definition suggests a conceptual framework with an anthropocentric point of view. According to van der Brande et al. (2011) and Peltonen (2017), the concept of sustainable development is too vague to be implementable and has thus started to lose momentum. It is difficult to measure; specific sustainable development approaches are more sustainable than others (Sauvé et al. 2016).

The concept of sustainable development put to an urban area project is defined as the “ability of the urban area and its region to continue to function at levels of quality of life desired by the community without restricting the options available to the present and future generations and causing adverse impacts inside and outside the urban boundary” (Brebbia et al. 2000 in Wallbaum et al. 2011, p. 21). In other words, a UAD should have the social quality that is desired whereby the built environment operates between the ecological boundaries without any restrictions in economic facilities and capabilities. Still, there is a question how? That is why in new studies, a combination of SD and CE appears.

The relation between CE and SD is described differently by researchers. Geissdoerfer et al. (2017, p757) claim that there is no clear conceptual relation between the two, just similarities and differences. They have verified this hypothesis with a coding search into “Circular Economy AND Sustainable Development.” Various researchers as the Ellen MacArthur Foundation (2013) and Ghisellini et al. (2016) argue that sustainable development is the main aim of CE and others that CE can be seen as the operationalisation of it (Kirchherr, 2017).

If CE is the operationalisation, it will ensure social, economic and environmental integration (as those are the three pillars of sustainability). Yet the research of Kirchherr (2017) finds that only 13% of the definitions of CE include all three pillars. The most elaborated research in the relation, similarities and differences of the two theories is done by Geissdoerfer et al. (2017). They found eleven relevant strategies of SD that overlap with CE. They based their findings on literature search in among others the articles of previously named researchers.

Similarities between sustainability and the Circular Economy
• Intra and intergenerational commitments • More agency for the multiple and coexisting pathways of development • Global models • Integrating non-economic aspects into development • System change/design and innovation at the core • Multi-/interdisciplinary research field • Potential cost, risk, diversification, value co-creation opportunities • Cooperation of different stakeholders necessary • Regulation and incentives as core implementation tools • Central role of private business, due to resources and capabilities • Business model innovation as a key for industry transformation • Technological solutions are important but often pose implementation problems

Figure 7: Similarities between CE and SD by Geissdoerfer et al. (2017)

The similarities are mainly focussed on process and strategy changes in development projects, instead of tangible changes in materials. These characteristics of sustainability and CE fit when operating a new sort of UAD process, a circular UAD. The differences between sustainability and CE lay in the motivation and goals, which have also led to the proposition of different systems in literature. According to the research of Geissdoerfer et al. (2017, p. 764): “The CE seems to clearly prioritise the economic systems with primary benefits for the environment, and only implicit gains for social aspects. Sustainability was originally conceptualised as holistically treating all three dimensions as equal and balanced”. Concluding, the SD is focused on benefiting the environment, economy and society equally and CE is focused on helping the

economy (at the core) and environment, and the social benefits follow indirectly. This comprises a narrow coverage of social wellbeing in CE (Geissdoerfer et al. 2017).

2.2.2 Circular economy and circularity

Circular economy entails a relationship between natural resources and the economic system. It is about a regenerative system that aims at closing cycles. The exact definition is highly discussed in the literature. When focusing on the built environment, Kirchherr et al. (2017, p. 224), after comparing 114 definitions of the circular economy, best describes CE as:
"An economic system that replaces the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes. It operates at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, thus simultaneously creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations."

The 114 different definitions are found by using a coding framework. This framework captures three core principles that describe the CE. If an article includes all three principles in his definition, it is talking about the circular economy, according to Kirchherr et a. (2017). The three core principles are: (1) the R-framework, (2) waste hierarchy and (3) system perspective. Before the analysis of Kirchherr et al. (2017), the most commonly accepted CE definition was provided by the Ellen MacArthur Foundation. The Ellen MacArthur Foundation is a very respected research institute concerning the circular economy. Their description of the circular economy is based on six schools of thoughts. (EMF, 2013). Table 5 gives an overview of the school of thoughts and what they include. The same school of thoughts are named as founding fathers of the circular economy by Geissdoerfer et al. (2017).

Table 5: School of thoughts (EMF, 2013)

School of thoughts	Description	Founder
Cradle to Cradle	Increase business market positions by eliminating waste, power with renewable energy, deal with resources an nutrients in a durable manner and at the same time respect humans & natural systems	Braungart & McDounough (2002)
Industrial Ecology	Closed loop systems for water, waste and energy	Clift (1998)
Biomimicry	Innovation inspired by nature. Nature as model, measure and mentor.	Benyus (2002)
Blue economy	Waste is resource	Pauli (2010)
Performance economy	Decreasing residual waste and material usage by realising product-service systems	Stahel (1976)
Regenerative design	Regenerative design that could be applied to all systems	Lyle (1970)
Natural Capitalism	Increase productivity of natural resources, shift to biologically inspired production models and materials,	Hawken, Lovins & Lovins (1999)

move to service-and-flow business model, reinvest in natural capital.

Circular strategies applicable to the built environment can be derived from these school of thoughts. Research in regenerative design is followed up by research in design for flexibility by Habraken (2007). The research of Kirchherr et al. (2017) also builds on aspects of these thoughts in their three core principles.

<u>The ReSOLVE framework and the **R-Framework**</u>

In addition to their school of thoughts, the EMF (2015) designed a reSOLVE framework for governments and organisations on how to apply circularity based on three principles. ReSOLVE stands for: Regenerate, Share, Optimise, Loop, Virtualise and Exchange. ReSOLVE is the translation of the three principles on the right into six circular strategies.

Furthermore, it emphasises a distinction in two ecological loops, a technical and a biological. The technical loop is in the blue loop; it includes the principles of the R-Framework that are also found in various researches. The visualisation in figure 8 means the more prominent the loop, the more energy is needed to execute the 'R'. This means the more prominent the loop, the less circular. The green loop is the biological loop, with focus on the biosphere.

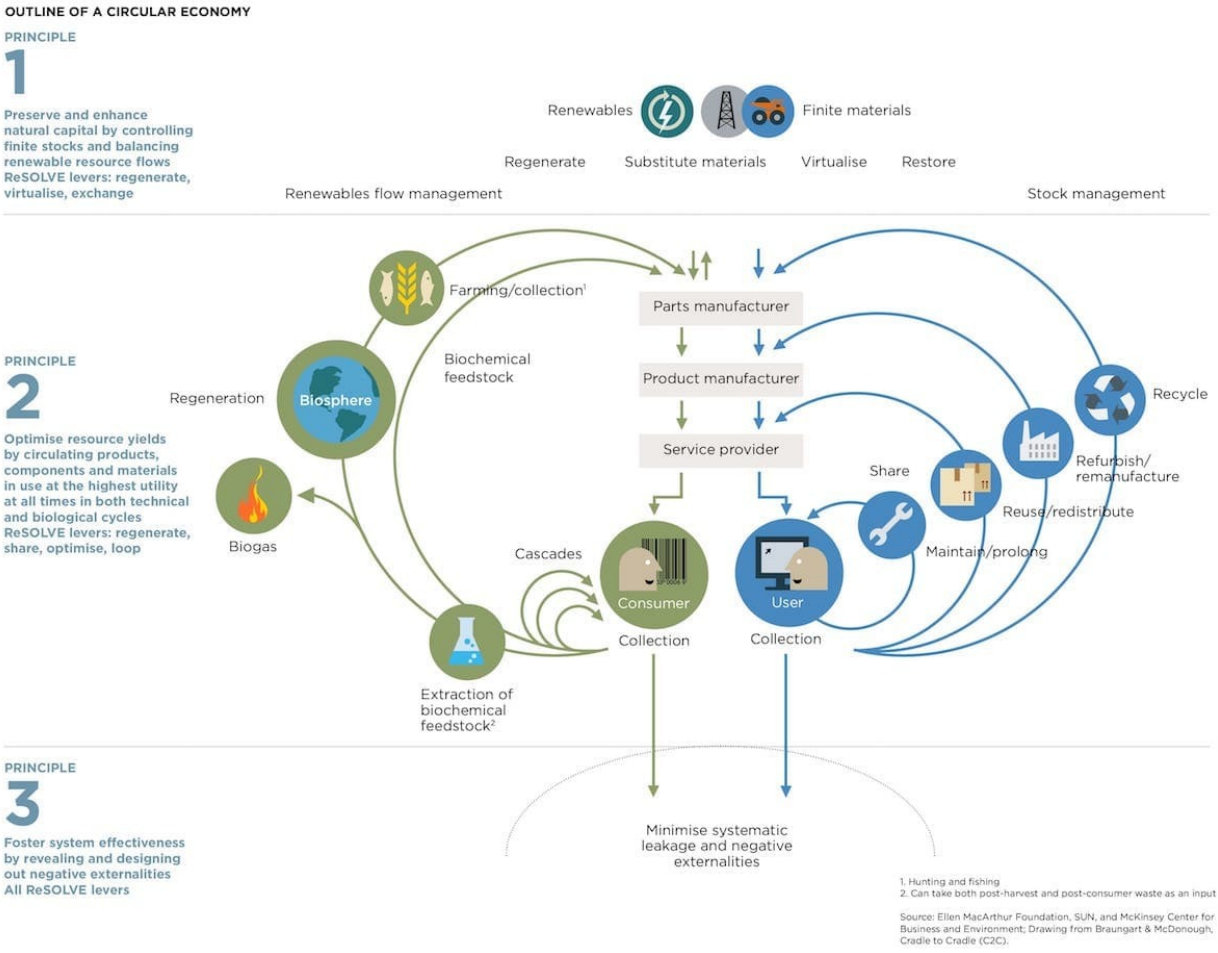


Figure 8: ReSOLVE Circular Economy system diagram by EMF (2018)

Kirchherr et al. (2017) also analysed the system diagram of the Ellen MacArthur Foundation. According to them, there are in total 10R's. They combined the different R-Frameworks and designed a '9R Framework' (it starts with R0) based on the existing frameworks of Potting et al. (2017 p.5) and the system diagram. This framework is the most extensive and therefore comprehensive framework at the moment in literature. Other widely used frameworks that use the same principles are the 4R framework in the European Union Waste Framework Directive (European Commission, 2008), the 6Rs (Sihvonen and Ritola, 2015), the 9Rs (van Buren et al., 2016; Potting et al., 2017) and the 10Rs of Jacqueline Cramer (2017).

The 10R's of Kirchherr et al. (2017). can be divided into three groups. The highest group is called the 'circular economy box'. It focuses on a different state of mind on product usage. In this group, for example, product and material leasing is a familiar concept instead of buying. In literature, this is referred at as the service economy (EMF, 2013).

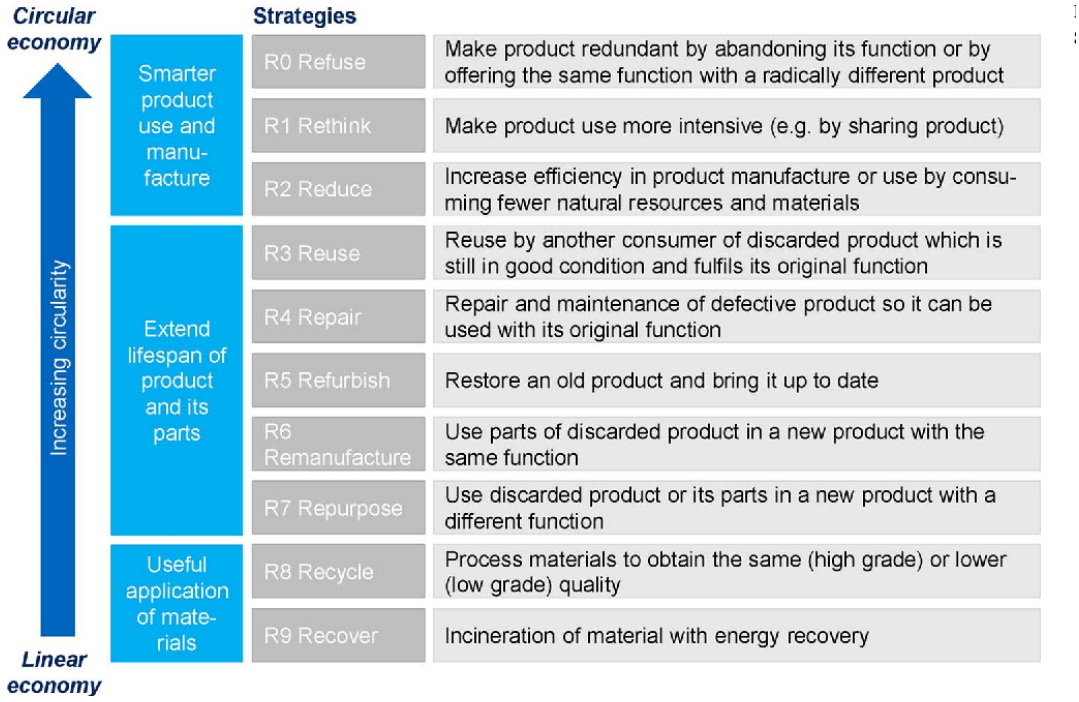


Figure 9: 9R Framework (Kirchherr et al. 2017)

Waste hierarchy

The waste hierarchy is added to the core principles of Kirchherr et al. (2017) after analysing the relation between the R's in the R-Frameworks. There is a hierarchy since the first R (in figure 9 Refuse) has priority and a higher circularity than the following R's. Various researchers suggest smarter product use and manufacture before recycling: a certain waste hierarchy. Overarching to the waste hierarchy is a closed-loop material cycle. This can be described for construction as building with the use of constituting materials and building elements that can infinitely be recycled through natural or industrial processes (Sassi, 2008).

In addition to that, the cradle-to-cradle (C2C) theories find support in this core principle. As the C2C was written about in 2002, various researchers aim that the CE builds on this concept (Linder et al., 2017; Kirchherr et al., 2017; Braungart & Mcdonough, 2002). Cradle to Cradle is a business model, where the priority lies in strong relations between suppliers and customers

(Braungart & Mcdonough, 2002). It is based on three principles: (1) Waste equals food, meaning that everything is a resource for something new. (2) Use sustainable energy sources, meaning energy should be renewable and (3) improve the resilience of a system through diversity, meaning every case is different, and no one solution fits all.

System perspective

System thinking is a core concept of the CE theory. A circular economy is not, for example, only about waste management or technology. It entails a system as a whole. Also, circular handling of resources includes economic, social, cultural, political and ethical aspects. The system perspective highlights that CE requires a fundamental shift and not only a twist in the current system (Kirchherr et al., 2017). Kirchherr et al. (2017) found, by analysing researchers on system perspective, seven articles on system perspective talking about three levels of the CE system: the macro system, the meso/regional system and the microsystem.

The most familiar system perspective in the literature on sustainable built environments is the ecosystem approach. This approach is used in the city scale (macro) and has therefore also interesting views for the UAD scale. In the ecosystem, buildings are designed for a complete life cycle. Using life cycle thinking ensures choosing circular principles that are sufficient during construction and operation as well as disassembly (Iyer-Raniga, 2019). The principles of circularity in practice are then, for example: using appropriate materials, renewal energy, adaptable designs, shared resources, lease of assets and similar approaches.

The ecosystem approach sees cities as a big open system built on subsystems with determining system boundaries. The urban environment consists of an indefinite number of variables that are somehow related, directly or indirectly (van Bueren, 2012). Van Bueren (2012) states that by distinguishing more significant systems into smaller systems, the chaotic web of variables and relationships can be framed. The subsystems can be distinct based on spatial scale, life cycle and flows. The essence of the approach is that it makes it possible to analyse parts of a system, for example, energy supply, without losing sight of the broader system context in which it is situated and by which it is influenced (van Bueren, 2012). To sustain the systems as an ecosystem, the challenge is to close the loops of the different flows. The strategy for the built environment that can be derived from van Bueren (2012) is to distinguish more significant systems into smaller systems when applying circularity.

2.3 Reflection and strategies

In the previous paragraph, the process of UAD and the most common theories on ‘circularity and ‘circular economy’ are analysed. The analysation of the UAD process will be used in the case study when the process of BSH is explained.

In the circular economy theories and principles described above, lie circular strategies that apply to the built environment. Circular strategies are the executive resources to facilitate the implementation of the higher goal of circularity/a circular economy. The strategies are derived from the theory and clustered into eighteen strategies. Strategies are grouped when multiple researchers suggest the same strategy. An overview of all the derived strategies and the clustering process is given in appendix I.

Table 6: CE characteristics for built environment

		Aspect	Strategy	Source
1.		**Energy**	Closed energy system	(EMF, 2015; van Bueren, 2012; Clift, 1998)
2.		**Energy**	Use of sustainable energy resources	(Braungart and Mcdonough, 2002; EMF, 2015)
3.		**Materials**	Closed material system, waste as a resource	(EMF, 2015; van Bueren, 2012; Pauli, 2010; Sassi, 2008; Braungart&Mcdonough, 2002)
4.		**Materials**	High quality reuse of materials	(Kirchherr et al, 2017; Sihvonen and Ritola, 2015; van Buren et al., 2016; Potting et al., 2017; Cramer, 2017)
5.		**Water**	Closed water system	(EMF, 2015; van Bueren, 2012; Clift 1998)
6.		**Economy**	Service economy	(EMF, 2015; Geissdoerfer et al, 2017; Stahel 1976)
7.		**Economy**	Businessmodel innovation as key for industry transformation	(EMF, 2015; Geissdoerfer et al., 2017)
8.		**Economy**	Use of potential cost, risk and diversification for value creation	(Geissdoerfer et al., 2017)
9.		**Economy**	Central role is in private business due to resources and capabilities	(Geissdoerfer et al., 2017)
10.		**Nature**	Non-economic building principles inspired by nature	(Braungart and Mcdonough, 2002; EMF, 2015)
11.		**Digital technology**	Use of digital technology for virtualisation	(EMF, 2015; Geissdoerfer et al., 2017)
12.		**Design**	Design for disassembly and flexibility	(Habraken, 2007; EMF, 2015; Kirchherr et al., 2017)
13.		**Design**	Coexisting pathways of development	(Geissdoerfer et al., 2017)
14.		**Scales**	Operate circular principles at al scales	(Geissdoerfer et al., 2017; Van Bueren, 2018; Pomponi and Moncaster, 2018)
15.		**Stakeholders**	Intra and intergenerational commitments	(Geissdoerfer et al., 2017)
16.		**Stakeholders**	Cooperation of different stakeholders	(Geissdoerfer et al., 2017)
17.		**Regulation and incentives**	Regulation and incentives as core implementation tools	(Geissdoerfer et al., 2017)
18.		**Research**	Make use of a multi- and interdisciplinary research field	(Geissdoerfer et al., 2017)

Table 6 shows the framework. All strategies are found in the theories of the researchers. The framework relies on current literature but is formed based on the author's judgements and knowledge, to decide if the strategies apply to the built environment. The framework is made to be as complete as possible, but a limitation is that not every theory on CE that is ever written is analysed.

An important note is that these strategies are on the most significant theoretical scale. Each strategy overarches a certain amount of practical circular strategies. Even though these strategies are still implementation tools of the CE, the strategies that are expected to find in practice will be on a different implementation level. This framework is based on the expectation that every circular strategy that is found in practice can be clustered under one of these seventeen strategies.

2.3.1 Reflection

The theory study is used as a method to find what circular strategies in literature can be found in UAD. The first search was into the process of UAD (2.1), described by open scientific sources. By analysing the theories on a process, the scales and deliverables of UAD an overview of the most critical decisions and phase are found. It is found that in the initiation phase and the feasibility phase, the implementation of circular strategies can be most effective and less costly. It can be learned from the theoretical background that for finding circular strategies, there must be dived into the process and the project of the UAD. The phases and its legally binding decision in figure 5 can be used to analyse the process of BSH. The framework of strategies can then be used as a handle to find circular strategies in practice in the projects.

The answer to the sub-question: What is circular urban area development, and how can it be found in practice according to the current literature studies? Is given by the framework in table 6. According to the theory, there are at least eighteen circular strategies that can be used to implement circularity in the built environment. Besides, the literature study confirms a gap in the literature that links circularity to UAD. A framework, as provided, is not found in earlier studies and research in the term “circular UAD” gives very little scientific studies that discuss this subject. Furthermore, the theories of CE are rarely focussed on the built environment, let alone UAD in particular.

It can be concluded that in the CE theories, multiple circular strategies hypothetically can be found in circular UAD. The study in the case Buiksloterham will point out if these strategies are relevant and achievable for circular UAD in practice.

3. Research Methodology

As explained in paragraph 1.2 Research Approach, a set of early on key decisions has resulted in the decision for a grounded theory approach for the theory research, and a process study for in the practice-oriented research. This chapter will provide additional reasons for choosing process research (3.1) and elaborates on the case selection and the in-depth case study (3.2). It answers the question: *How to analyse a real-time urban area development project for circular strategies and the role of the municipality?*

3.1 Process research

A process research approach is used to study the development of the urban area Buiksloterham. Process studies are undertaken to examine research questions dealing with change and development over time (Van der Ven, 2007). The qualitative method for analysing process data is 'historical chronology'. This entails a study in sample events that took place in BSH. The sequence of several events defines the process of the development in BSH.

The sample diversity is heterogeneous, as there are process and project events studied. Other operational issues that apply to process research are described by Van der Ven (2007). Table 7 discusses these nine issues and explains the decisions for this research.

Table 7: Key decisions of process study

Issue (Van de Ven, 2007)	Decisions (van de Ven, 2007)	Process study decisions	Explanation
1. **Meaning of process**	A category of concepts or a developmental sequence?	Developmental sequence	The developmental sequence approach is used to study the events.
2. **Theories of process**	Examine one or more models?	Multiple	Multiple models have led to the strategy framework, and multiple research techniques are used for the research.
3. **Reflexivity**	Whose viewpoints feature?	Multiple	The two main viewpoints that are featured in analysing the projects are the developer's viewpoints and the municipality's.
4. **Mode of inquiry**	Deductive, inductive or reproductive?	Reproductive	The study will analyse from cause to effect with an analytic framework derived from literature. It will also search for unusual observed

				facts, what entails working back from effect to cause.
5.	**Observational method**	Real-time or Historical Observation?	Both	Historical and real-time observation will be used. Mostly historical observation in the cases, but the UAD is a real-time development project.
6.	**Source of change**	Age, cohort or transient sources?	Chronologic	The process is defined by how events happen and change over time
7.	**Sample diversity**	Homogeneous or heterogeneous?	Heterogeneous	The samples can be placed under two categories. A process event or a project event.
8.	**Sample size**	Number of events and cases?	Multiple events and cases	The area that is studied consists of multiple cases.
9.	**Process research designs**	Which data analysis methods to use?	Document study and interviews	Both have an explorative approach. Mainly by documents and some events are derived from interviews.

3.1.1 Lists of events

A process study studies events over time. The lists of events can be found in appendix II. It is decided to divide the events into two levels, in line with the two deliverables in executing a UAD (paragraph 2.1.2, theoretical background). The result is a list of process-based events and project-based events.

The events in the process list are (found in) policy documents. The events are categorised in the policy levels the events are found within. These policy levels are European Union, the Dutch government, City of Amsterdam and Buiksloterham. The project list of events consists of all the building projects that are completed or passed the first planning phase. The projects planned for construction but not yet started, are not in the list of events. The aim of circularity/sustainability in the projects is derived from open publications and documents.

The lists consist of multiple columns. The event column describes, in short, the deliverables of the project and the essential information. The dates that are presented are the tender date and the date of completion. The observation of the project list describes the (planned) circularity/sustainable deliverables in the project.

Table 8: Fragment of list of process events

Event #	Policy layer	Event	Date	Observation
D20	BSH	Manifest Circulair Buiksloterham	2015	Initiative by inhabitants of Buiksloterham. Over 25 parties sign a circular manifest. The municipality translated the manifest

into a concrete program for a circular development in Buiksloterham.

By observing the events in both lists, the process of the development of BSH is defined in chapter 4. It aims to give a complete overview of what is constructed in Buiksloterham and the decision-making process. The process of Buiksloterham includes twenty-two construction projects, described in the list of project events.

3.1.2 Case Study research

A case study is relevant when the question is a (why and) how question (Yin, 2006). It helps when covering contextual conditions and when the boundaries between phenomenon and context are not clear (Yin, 2006). Here, a case study is done to get a more in-depth view of how circular projects are delivered in the area, what circular strategies are delivered and how the municipality was involved in the realisation of the circular projects. An overview of Buiksloterham's construction projects (appendix II) is given in figure 10.

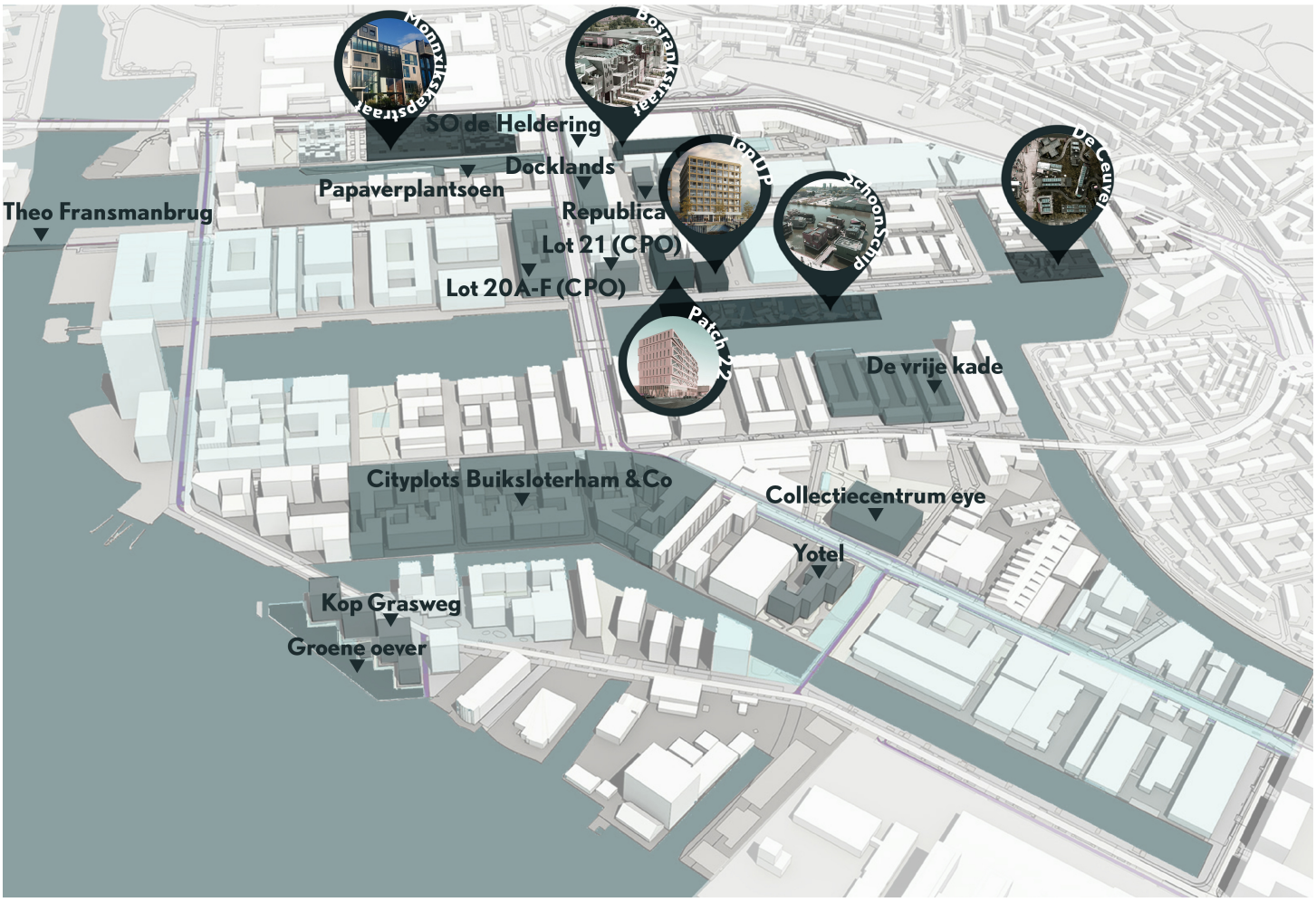


Figure 10: Overview of construction projects in Buiksloterham

3.1.2.1 Subcase selection

Buiksloterham is not considered as a case in its entirety, due to the exclusion of GWW, and due to a limitation in time and resources. In addition, Van der Ven (2007) states that one of the common pitfalls associated with studying cases is the tendency of researchers to try attempt answering a question that is too broad or a topic that has too many objectives for one study.

As Buiksloterham is an extensive construction project with a lot of stakeholders, interested parties and sub-projects, this is a real hazard. Several authors have suggested that placing clear boundaries on a case or dividing the case in smaller cases can prevent this (Yin, 2003; Stake, 1995; Van der Ven, 2007). Therefore, four subcases in Buiksloterham are chosen. The project list of events is used to funnel the urban area into smaller cases. Besides, the cases are selected based on a set of criteria. The criteria are established to give an as complete view as possible of circularity in the area.

In BSH, only one infrastructure project is finished (event 1). This is not enough to get a realistic view of what is done in circularity and the involvement of the municipality in the public space. Therefore, the focus is turned to real-estate projects. In addition, the projects have to be completed. Circular ambitions are not the same as implemented circular strategies. The difference between the ambitions and the implementation of the strategies are interesting for this research. Then, the projects should have a distinct ambition for circularity, and the role of the municipality should be active and transparent. Lastly, there must be accessible information about the decision-making process in order to make a complete analysis.

Summarised, the criteria of the subcases are as followed. The project/subcase should:

- be a real-estate project;
- be constructed and delivered;
- have a distinct ambition for circularity;
- have accessible information about the decision-making process;
- have an active role in the process

For every project, the databases of the municipality and the open-source documents are analysed to see if the projects meet the criteria. Table 9 gives an overview of the selection. Six projects came out suitable for an in-depth case study (table 9, figure 10). De Ceuvel, Patch 22, SchoonSchip and the Bosrankstraat are chosen. The projects are comparable in their ambition and execution of sustainable and circular designs. They vary in function, the way they are issued (competition for ground-lease, tenders, lot issue) and the organisational structure (private commissioning (Dutch: zelfbouw), collective private commissioning (CPO) and private project developing company). Because of this variation, they make a realistic reflection of circular real-estate in the area. Bosrankstraat is chosen over the Monnikkapstraat, although the projects are comparable, Bosrankstraat was developed firstly and more innovatively because it was the first private commissioning project in BSH which made it a novel process for the municipality. According to the interviewees in the Bosrankstraat, the municipality learned a lot from their project. Patch22 and TopUP are developed by the same architect and project developer. Patch22 was again the first, and due to the tender, there was a legally binding agreement for sustainability goals, which resulted in more realisation of circularity according to the architect.

Table 9: Overview of total of projects in BSH and the criteria

	Real estate project	Constructed and delivered	A distinct ambition for circularity and/or sustainability	Accessible information about the decision-making process	Municpality has an active role
SO de Heldring	X	X			
Theo Fransmanbrug		X			X
De Ceuvel	X	X	X	X	X
Collectiecentrum EYE	X	X			
Docklands	X	X	X		X
Patch22	X	X	X	X	X
Lot 21: PUUUR, Black Jack, Nova Zembla, De Hoofden, Noord4US, Elta	X	X	X		X
Bosrankstraat (Lot 5)	X	X	X	X	X
Lot 3 (Monnikkapstraat)	X	X	X	X	X
Yotel	X	X	X	X	
De Groen oever		*partial*			X
Lots 20A - F	X	X	X / -		X
Papaverplantsoen		*partial*	X	X	X
TopUp	X	X	X	X	X
Schoon Schip	X	X	X	X	X
Vrije Kade 1	X		X / -	X	
Lot 2	X		X / -	X	
Republica	X		X / -	X	
Cityplots (Buiksloterham&CO) (lot 47-48-49)	X		X	X	
Kop Grasweg	X		X / -	X	
Hotel Grasweg 46	X		X / -	X	
New Road between Klaprozenweg and Grasweg			X	X	

3.1.2.2 Data gathering

This research is searching for lessons learned in those historical events (realised circular projects) by using historical observation. It includes gathering data via retrospective interviewing and thorough examination of documents (Bryman, 2016). Data gathering in the case study is done via project analysis, document studies and interviews (figure 11). A combination of the three data gathering methods offers the ability to gain enough knowledge from practice. The interviews will be qualitative and are explained in the next paragraph. Chapter two has provided a theory on the topics, and the analytical frameworks of strategies and urban area development will be used to analyse upon.

The interviews mean to reveal (in detail) the way developers and inhabitants dealt with implementing circularity in real-estate projects in Buiksloterham. The data is extracted from the transcripts of the interviews.

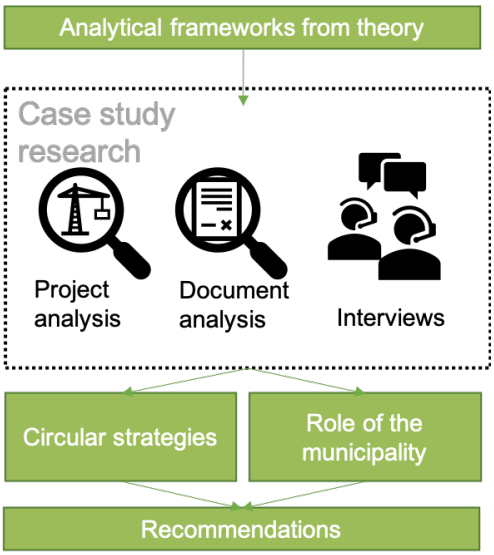


Figure 11: Data gathering method (own ill.)

3.1.2.3 Qualitative interviews

The appropriate method for qualitative interviews is often by semi-structured interviews with open questions (Bryman, 2016). The aim of conducting these semi-structured interviews is to gather specific data that cannot be found in (policy) documents.

Two sets of interviews are conducted. At first, the cases are analysed through the eyes of the developer. The viewpoint of a developer can be experienced either by a project developer, an architect, an inhabitant or both. The persons are selected based on their role (on the development side) in the project. In every project at least an architect/developer and an inhabitant are interviewed. The roles are intertwined in BSH, as a lot of developers developed their own houses. Based on some explorative questioning with inhabitants in BSH, architects and developers tend to know a lot about the possibilities for building innovations regarding circularity, the building decree, the land use plan and the role of the municipality during the planning and construction phases. In addition, inhabitants tend to have additional knowledge about the urban area as a whole and the circularity within. Interviewing both gives a representative view how it is experienced to develop a circular project in 'circular' BSH.

The first interview is divided into three topics (1) general information on the case, (2) circular strategies and (3) the role of the municipality in the projects. The complete interview questions can be found in Appendix II.

1. General information

   The general questions are asked to get a better understanding of the specific case and the role of the interviewee. It is asked to find additional information on the cases that cannot be found in open sources and documents.

2. Circular strategies

   The interviewees are asked what they understand by circular economy/circular strategies. In addition, it is asked how they imply circular Buiksloterham. The first question is asked to test if they have the expected knowledge on circularity and the second to find out what the interviewees think of the term circular Buiksloterham and if it is appropriate for their neighbourhood. The following questions aim to test the theory framework in the cases. The

interviewees are asked during the interview to comment on the framework and to imply the framework on their project.

3. Role of the municipality
These questions aim to find out how the municipality participated/what role the municipality fulfilled for the developers/inhabitants while realising their projects. The questions are structured to find if there were incentives from the municipality for circularity and what the barriers were. It is also asked if the interviewees had advice for the municipality in order to make it 'easier' to implement circularity as a project developer.

Table 10: Interviewees

	Case	Discipline	Viewpoint
Interviewee 1	De Ceuvel	Architect	Developers
Interviewee 2		Inhabitant / Participant	Developers
Interviewee 1	SchoonSchip	Architect	Developers
Interviewee 3		Inhabitant Architect	Developers
Interviewee 4	Patch22	Architect Project developer	Developers
Interviewee 5		Inhabitant	Developers
Interviewee 6	Bosrankstraat	Architect Inhabitant	Developers
Interviewee 7		Architect Inhabitant	Developers

The second set of interviews is conducted with experts of the municipality, who have actively worked with implementing circularity in urban area development. The interviewees are selected based on that they worked in this field during the realisation of the cases. They have concrete knowledge and experience with circularity in the built environment. One is specialised in sustainable building techniques and strategies and the other in permits and interaction with civilians. Both interacted as circular/sustainability counsellors during all four of the projects in Buiksloterham.

The interviews aim to elaborate on the barriers that developers found in their projects. The viewpoint of the municipality is critical to reflect upon the experiences of the developers. The interview questions can be found in Appendix III.

Table 11: Interviewees municipality

	Department	Discipline	Viewpoint
Interviewee 8	Ruimte en Duurzaamheid (stadsdeel Noord)	Senior advisor circularity in urban area development	Municipality of Amsterdam
Interviewee 9	Ruimte en Duurzaamheid (stadsdeel Noord)	Senior advisor circularity in urban area development	Municipality of Amsterdam

3.2 Limitations and method discussion

1. This research maps circularity in an urban area development project. A process study in an urban area development is extensive. Some aspects of UAD are outside the scope (GWW), but still, many aspects are included in this research. This explains why many different topics are discussed briefly and why not every topic is discussed in depth.

2. The process study uses historical observation as the observational method. It entails looking back at situations and using data from retrospective interviewing and studying documents produced by others. The development of the cases is not observed by the researcher, so the findings depend on the observations and recollections of others.

3. This research will provide findings based on the experiences of individuals. Interviewees all have different perceptions of (sometimes the same) processes, which makes the experiences subjective. The interpretation in results from the researcher is also subjective. Moreover, as the interviews are the primary data source, the quality might be limited. Interviewees might have personal interests in the outcomes of the research or neglect to give complete information. To reduce this limitation, multiple interviews per case are conducted. Besides, the interviews are conducted with key informants in the project. The outcomes of the interviews will be checked (when possible) with other sources. This could be documents, real-time project analysis (visiting the project) or general information found on webpages that have been analysing the development in Buiksloterham.

4. The interviews are conducted with two participants in every project and with two municipal officials. Due to a limitation in time and resources, consideration had to be made about the number of interviews. It is decided that this number of interviews gives enough information to answer the main question. The participants are all highly involved with the realisation of the projects. Therefore, enough data can be gathered to analyse the role of the municipality and the circular strategies in the projects and the urban area. Nevertheless, more interviews could have provided some more information. Important note for the interviews in SchoonSchip and the Bosrankstraat is that both cases consist of multiple houses that are all designed differently by different architects. The circular strategies that are found by these interviewees do not count for all the single houses in the projects, and there might be more/different practical aims of the strategies in other residences.

3.3 Methodical framework

The following figure summarises the methodology for answering the main question.

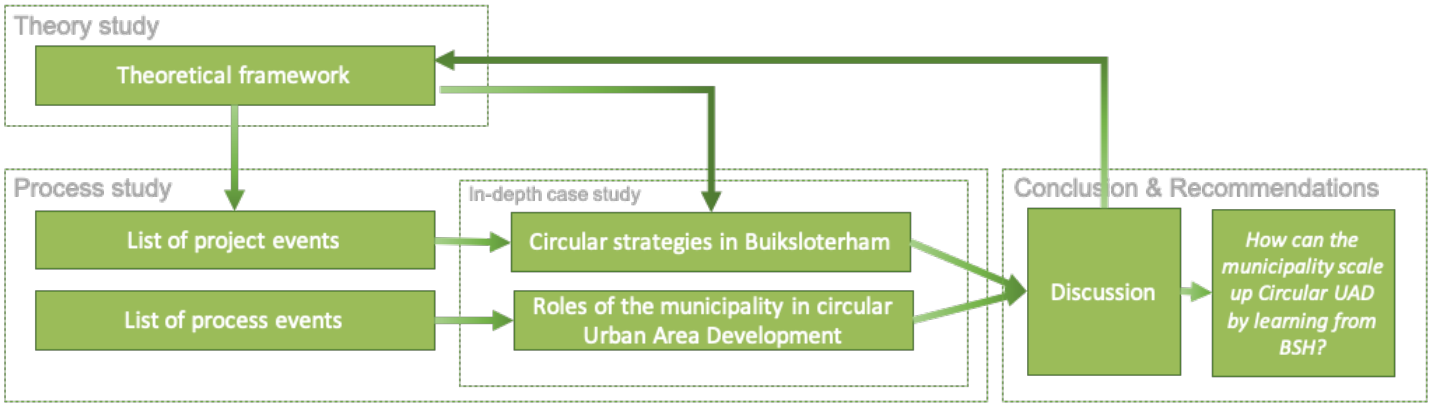


Figure 12: Methodolocial framwork (own ill.)

Part III - Case study

Chapter 4 – Urban area development Buiksloterham

Chapter 5 – Circular strategies

Chapter 6 – Case study reflection

Source: Delva Landscape Architects Urbanism

4. Urban area development Buiksloterham

This section studies the events, activities and choices in the urban area Buiksloterham and four sub-cases. Part III the case study (chapter 4, 5 and 6) aims to answer the subquestion: *How are circular projects developed in Buiksloterham and what role does the municipality play in the development?* Both the policy and management issue and the practical issue of circular urban area development are covered in this part.

Chapter 4 starts with an analysis of the process and project events in Buiksloterham. The process (4.1.1), is based upon the theoretical background on UAD. The aim of paragraph 4.1 is to have a better understanding of the development of BSH and the roles the municipality can play in projects in urban area development. Section 4.2 briefly describes the subcases and the role of the municipality there. Paragraph 4.3 discusses the process versus the projects, based on the case study in the subcases and the process study.

4.1 Development of Buiksloterham

4.1.1 The process of Buiksloterham

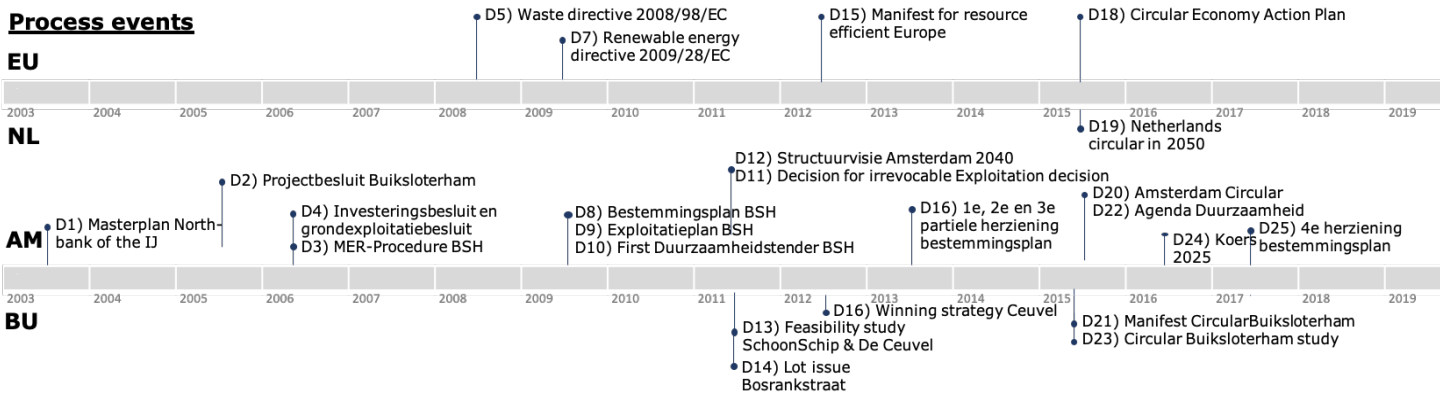


Figure 13: Timeline of process events

Initiative

The first initiative for the redevelopment of Buiksloterham was in 2003, in the urban plan for Amsterdam North *(D1).* The first project plan with the ambition, scope and plans for Buiksloterham was published in 2005 (*D2*). A first SEA is started in 2005 (Dutch: MER-procedure) (*D3*).

Feasibility

Projectbureau Noordwaarts (established by the municipality of Amsterdam, later part of Grond & Ontwikkeling) became responsible for the feasibility phase of Buiksloterham. This includes forming a land-use plan, a final urban design plan, the EIA) and a project plan, including the realisation of the public space (Gemeente Amsterdam, 2009). It started with the investment decision for Buiksloterham (Gemeente Amsterdam, 2006a). In the additional first exploitation plan (Noordwaarts, 2006b), it was noted that the interest in Buiksloterham would grow exponentially. And on the 20th of December 2006, the local council of Amsterdam accepted

the exploitation and investment decisions and decided that the municipality could invest in Buiksloterham. The investment decision describes in outline the plans of a '*gradual, organic redevelopment of an industrial area into an area where living and working are mixed at different levels of scale.'* This formed the legally binding land-use plan in 2009 (Gemeente Amsterdam, 2009). The decision was made not to develop a traditional urban plan but to let investors and inhabitants design inside a framework (Bestemmingsplan, 2009). Another interesting choice in the land-use plan was not to acquire all the land in the area but leave 2/3 of the ground by its traditional owners. This decision was financially motivated because the cost of the polluted soil made the project expensive and risky (Gemeente Amsterdam, 2016a). Every year there are partial revisions of the Exploitation Decision. At the time of this research, the land-use plan is partially reviewed on particular parts of the area five times. A full revision of the land-use plan is in process and planned to be in operation in September 2020.

Realisation

The first tender for four lots on the municipal ground was issued by the municipality the same year as the land-use plan (2009). This was the first tender where the city rated on sustainability criteria. These tender criteria mainly focussed on energy efficiency. Patch22, Docklands and Lot21 (*event 7)* won the bid, only the latter one got delayed by bankruptcy of the project developer and was newly issued in 2012.

In 2011 the municipality held a competition for the development of a small area on polluted soil. It was won by the developers of the Ceuvel. This was the first large project in BSH after the ones issued in 2009. The downturn due to the economic crisis slowed down the development (Gemeente Amsterdam, 2016a). To still attract some investors and developers, the municipality focused on tenders with sustainability criteria and (collective) private commissioning projects. Between 2012 and 2015, four of these projects started.

In the first investment decision in 2006, a realisation of 4000 dwellings was committed to. 50% of the 1.000.000 GFA (Dutch: BVO) in Buiksloterham was planned as a working area. The latest version in 2019 (*D31*) includes plans for 8575 dwellings with 36% workspace. The recalibration of the Investment Decision doubles the number of dwellings within the area. In entails a total growth of 114% for the number of houses and a reduction of 28% in the workspace. As the building area is not growing, the new buildings are expected to take over public space (Gemeente Amsterdam, 2019). This decision is established based on the 'Koers 2025' (*D24)*, a policy document of the municipality regarding housing problems. In Koers 2025, Buiksloterham was selected as a mixed-use neighbourhood and as an area that can quickly help reduce the housing problems.

Regarding sustainability, Amsterdam published new ambitions for 2040 (*D12*). The EU issued a manifest for resource-efficient Europe (*D15)*, with a focus on the growing climate problems and the problems with running out of fossil fuels. This is followed up by a Circular Economy Action Plan (CEAP) in 2015 (*D18)*. It was one of the first official policy documents by the EU acknowledging the circular economy as a solution for climate problems. The Dutch government translated this in 'Nederland Circulair in 2050' (*D19*) and the municipality in Amsterdam Circular (*D20)*. In the latter one, Buiksloterham comes forward as pioneer and leader for the Amsterdam urban area developments in the field of sustainable and circular development in this document. Apart from some revisions in the Exploitation decision that contributed to a few

circular strategies, this was one of the first documents Buiksloterham is seen explicitly as a new circular urban area development.

The manifesto came around the same time as the climate agreement in Paris and the (CEAP). Circularity and circular economy became more trending topics after that. The manifesto was published in 2015 and was an initiative of citizens and Waternet, but probably received more support because of the decision on EU level. The manifesto can be read as an intention agreement and a declaration of voluntary commitment. It consists of assumptions for innovations regarding high-quality reuse of materials, local energy sources, biodiversity and data sharing. According to one of the writers of the manifesto and the additional Circular action plan Buiksloterham *(D23),* the first intention was to realise a binding set of commitments.

4.1.1.1 Policy levels in process

In this process study, there are different policy layers, the European Union (EU), the Dutch Government, the Municipality of Amsterdam, and Buiksloterham. The separate policy layers are interesting because there is a top-down influence on the policy and decision making coming from the EU. The circular rules of the Municipality of Amsterdam are almost entirely controlled and dominated by the European Union and the Dutch government (Van den Berghe & Vos, 2019). For example, directives D5 and D7 are translated by the Dutch government in ambitions in Netherlands Circular in 2015 (*D19*). The manifesto of the EU (*D15*) resulted in the Circular Economy Action Plan Circular (*D18*), both not directives but supporting documents with ambitions. The list of events implies that there are no enforcing circular rules, only ambitions. The ambitions of the municipality may differ from the ambitions of the national government, due to its non-legally binding nature. (Van den Berghe & Vos, 2019).

4.1.2 The role of the municipality

While studying the process of Buiksloterham, various roles of the municipality during urban area development are identified. The roles are found in documents or during the interviews with participants of the projects. In the interviews with the municipality, these roles are discussed to establish which roles the municipality participated in circular development.

The roles are divided into private and public roles. The private role in urban area development falls mainly under the department Grond & Ontwikkeling. The roles that are found for the municipality associated with selling the ground or issue as leasehold in projects in BSH are the following:

Table 12: Roles of the municipality in UAD in general and in Buiksloterham

Private role	Description	Interviewee information for circular Buiksloterham:
Landowner	Selling or leasing land to project developers (or smaller organisations like (collective) private commissioners). Determination of the land value and requirements for the land issue	
Directive	Establishes associated requirements for land use.	In selection documents higher ambitions for quality, green, water,

	energy and circular building principles are established.

The public role of the municipality is to serve in the collective interest of the inhabitants. It should assure that quality is delivered, and that socially desirable developments are stimulated.

Public role	Description	Interviewee information for circular Buiksloterham:
Controlling	Writes land use plan. Issues permits. Tests if the provisional and final design of the developers meet the requirements of the building decree and the additional ones.	Tests provisional and final design at the ambitions of Buiksloterham and the award requirements
Facilitating	Offers grants for sustainable development Offers experimental permits via the crisis and recovery law (Dutch: crisis en herstelwet (chw)) Offers possibility for article 19 procedure (exception on land use plan)	Integration heat and cold storage and pipes in street profile. Advise for building with green, water, circularity and energy neutral
Initiating	The municipality can put initiatives on the market	The municipality challenges the market to achieve a higher sustainability ambition / social goal.
Executive	Executive party for the development of the public space Coordination between developer and other governments	Coordination with developers and between other governments like Rijkswaterstaat and the province.

4.1.3 Projects in Buiksloterham

The current management area of Buiksloterham is 128.000m2. At the date of this study, it consists of a lot of wasteland, concrete high-rise buildings and construction sites. You have to take a closer look to find the innovations that cover the term ‘circular’ Buiksloterham. An eyecatcher is the development of a floating self-sustainable village in the Johan van Hasselt canal (SchoonSchip). One block further individual self-builders have realised two streets with all sorts of sustainable houses. There are plans for public parks maintained and initiated by citizens. Two high-rise buildings have construction of wood. There are an office park and science centre on contaminated land. And behind the scenes, you find collaborative private partnerships realising urban blocks sometimes even together with social housing corporations. The full list of projects and a timeline of the projects can be found in Appendix II.

The planning of the municipality includes the realisation of a riparian parc at the IJ-oever, full of green and reused materials. These plans are still in the initial phase. Same as the rest of the redevelopment of the public space, including parks and squares. The newly issued real-estate projects can be found in the list of events in Appendix II.

4.2 Subcases

4.2.1 De Ceuvel

Table 13: Characteristics De Ceuvel

De Ceuvel	
Issue	Wining of competition by municipality 2012
Completion	2014
Function	Office park & cafe
Design	Space&Matter
Prices	Most sustainable initiative by 'Duurzame Dinsdag'
Involved interviewees	1. *Architect Space&Matter (interviewee 1)* 2. *Participant and tenant (Interviewee 2)*

In 2011 the municipality took the initiative to organise a competition for a ten-year lease project for a piece of land in Buiksloterham. Project De Ceuvel won the tender (D15) and together with a group of architects, artists and catering entrepreneurs a new small city was realised. It includes a café and fifteen offices in second-hand living boats. The completion of the project was in 2014. It was the first realised project with high sustainability ambitions in Buiksloterham.

One of the requirements by the municipality was that it was not permitted to build on the heavily contaminated soil. According to *interviewee 1*, the tender was focussed on which group had the best idea for the ground. The architect firm Space&Matter was at that time busy designing SchoonSchip and already performed a feasibility study (D13) in BSH together with Metabolic. They took on the Ceuvel as extra project and realised a temporary circular breeding ground.

Municipality

According to the interviewees of De Ceuvel, the municipality had an initiating role for Project De Ceuvel. They also offered a lease, as they are still the owner of the land, fulfilling the role as the landowner. Besides, they had a (small) directive role as they established associated rules for the construction. For example, the developers were not allowed to build in the polluted soil. Both interviewees are mostly positive of the role of the municipality during the project.

Circularity

The ambition of the developers of the Ceuvel was a full sustainable real estate project. The reused living boat offices were developed by the tenants. They mostly put their capital in the redecoration of the living boats and rafts. In between the ships, a boardwalk of reused scaffolding wood has been built. Under the scaffolding, a garden has been planted with various soil-cleaning plant species. According to the interviewees, the architect of the Ceuvel designed almost all tangible assets from used materials.

De Ceuvel is almost energy self-sufficient. In figure 14, you can see that all former boats have PV-panels on their roofs. It remains a connection to the main energy grid (*Interviewee 1*). Under the name, 'Jouliette' new technology is tested to exchange locally generated. It is a local digital trading platform that can be used by people in the neighbourhood. These plans are made in collaboration with network operator Liander and SchoonSchip.
The Ceuvel has waterless toilets. There is a greywater system for wastewater, and they can locally produce drinking water. The water quality is approved by Waternet but only official water

companies have requisite permits, so it cannot be used in the offices and Café. A complete overview of the circular strategies that are found in De Ceuvel is given in paragraph 5.2.

Figure 14: De Ceuvel from above and the cafe after realisation (source: De Ceuvel)

4.2.2 SchoonSchip

Table 14: Characteristics SchoonSchip

SchoonSchip	
Issue	Wining tender 2013
Completion	2020
Function	Residential area
Design	Space&Matter
Prices	Nomination 'Amsterdamse Architectuur prijs' 2020 European Solar Award
Involved interviewees	Architect of Space&Matter *Interviewee 1* Inhabitant and single lot architect *Interviewee 2* Inhabitant and single lot architect *Interviewee 3*

Initiators of SchoonSchip started looking for a place to develop their sustainable floating village in 2008. Together with a small group of future inhabitants, they formed a CPO. In 2013 the water-lots were sold to SchoonSchip, via official tendering. The tender included the design for an urban village on the water with thirty floating lots for forty-five residences. Architect firm Space&Matter designed the town and made an urban plan. Consultancy firm Metabolic executed a feasibility study focussed on the realisation of circular/sustainable ambitions. The CPO group included various architects who designed their lot. Therefore, every ship and every lot have other extensions of the basic design (*Interviewee 3*). Before the tender in Buiksloterham, the group found a place in the canal in Houthavens, Amsterdam. This request was rejected by the municipality, but in collaboration, they found the Johan van Hasselt canal in Buiksloterham. In the beginning, the plan included social housing, but due to the problematic new character of the urban area, this was not possible to realise.

Municipality

The municipality "was heavily involved with a lot of different people fulfilling different roles" *(Interviewee 3*). The land is sold to the CPO SchoonSchip, with the municipality as the private role of the landowner. The directive role included the additional requirements the municipality asked in the tender. The facilitating public role is found in issuing experimental permits, grants, and the help of the organisation of mobility as a service (MAAS)-model (*Interviewee 1* and 3). Also, a revision of the Land-Use plan was necessary (D16), for sale of the lots in the canal. The municipality had a controlling role issuing permits and controlling the tender criteria.

All three interviewees involved in SchoonSchip are mostly positive on how the municipality interacted in the project. "There were complex things, banks, lawyers and the municipality had to deal with all kinds of new constructions" (*Interviewee 2*). As a result, SchoonSchip had a lot of delays and took almost ten years to finalise, but this was not consciously stopped by the municipality according to the interviewees. "The municipality helped us with permits and made changes in the land use plan, they coordinated within the project and were a chain at project level between different departments" (*Interviewee 1*). The project manager of the municipality in Buiksloterham changed a lot. This led to numerous unnecessary new knowledge exchanges what also led to delays.

Circularity

According to *interviewee 1, 2 and 3* circularity and sustainability are highly valued by every participant of the project. This applies to the design and construction of the village, but also to the way of living. They aim to be a sustainable community. The founders of the project had an intrinsic motivation for sustainability. “We challenged ourselves to be more sustainable than the menu scorecard of the municipality, what already stimulated us to have high sustainable ambitions.” (*Interviewee 3*). The menu scorecard was used for the tender. The result is that SchoonSchip is the most sustainable floating village in Europe.

The houses are not connected to natural gas. For heating and electricity, heat pumps, passive solar energy, WTW-installations (Dutch: warmte terug win) and PV-panels are used. The lots have big batteries for the storage of energy and have only one connection to the main power grid. They realised a ‘smart-grid’ in their village, to exchange energy with each other. After operating this system for energy for half a year, they did not have to use the connection to the main grid yet (*Interviewee 2*). The tender includes plans for green roofs, at least 1/3 of every house (*Interviewee 8*). These have not been realised yet. Besides, a subsidy is granted for floating gardens (*Interviewee 2*), which are not yet built. All circular strategies implemented in SchoonSchip can be found in Appendix II event 13.

Figure 15: SchoonSchip from above (source Space&Matter)

4.2.3 Patch22

Table 15: Characteristics Patch22

Patch22	
Issue	Winning tender 2009
Completion	2016
Function	Residential apartment
Design	FRANTZEN et al architecten
Prices	Amsterdamse Nieuwbouwprijs 2017 Gouden Piramide 2018
Involved interviewees	Architect and project developer *Interviewee 4* Inhabitant *Interviewee 5*

Patch22 won the first tender that was written for BSH in 2009. The tender was a special one, as the municipality granted on sustainability instead of on financial bid (*Interviewee 4 and 7*). It is a 30meter high-rise building. The tender criteria by that time were mainly focussed on energy efficiency (*Interviewee 4*). One other high-rise project started at the same time as Patch22, Docklands, but Patch22 stood out on its circularity criteria. A few years later, tendered in 2012, six more high-rise projects started in BSH.

The architect designed Patch22 for an 'airframe delivery', meaning without any installations or interior, just the frame of apartments. This was part of the design for flexibility principle (*Interviewee 4*). The building was delivered in 2014. The same architect and developers group started a renovation project on their initiative with the adjacent building, TopUp.

Municipality

The interviewees mainly mention the private role of the municipality, as the landowner who sets the price of land. The land price is based on market value minus the foundation costs. The architect and project developer had a lot of issues with this formula, in terms of the establishment of those two variables. The directive role came in the establishment of the additional tender criteria. The private role of the municipality seems rather dominant for project developers, as a lot of issues during the construction were linked to the department of land affairs, according to *Interviewee 4 and 5*. The controlling role is found in the issuing of permits and by controlling the tender criteria.

Both interviewees of Patch22 are mostly negative on how the municipality interacted in the project. "If we would have followed the method and procedure of the municipality, Patch22 would not have been sustainable at all." Besides, *interviewee 4* blames the municipality for going bankrupt during the realisation of their follow-up project TopUp. "The department of land-affairs blocked every circular ambition we had, by increasing the land prices extremely" (*Interviewee 4*). They did not have a tender agreement with the municipality in Top-Up. *Interviewee 4* gives that as a reason they could not realise their circular ambitions. *Interviewee 5* says the circularity in Buiksloterham is only 'for the stage'. He illustrates this by saying that the use of electric cars for inhabitants of the loft is discouraged, because of the high additional cost payable. This is remarkable as within SchoonSchip the municipality contributed to a successful MAAS-model with electric cars.

Circularity

An outstanding feature of the design of Patch22 in 2009 is the use of wood as the main structure. The building is designed to be energy neutral, meaning a total annual energy consumption of net-zero. This is realised using PV-panels on the roof, CO2 neutral pellet stoves and insulation (*Interviewee 4).* According to *Interviewee 5*, the EPC is not zero but is very low.

There are plans for a grey-water system using rainwater. *Interviewee 5*, the inhabitant of the building, was not sure if the system was connected in the end. Designing for flexibility is found in hollow floors and ceilings, hull delivery for buyers and installation in walls. The airframe design is supposed to meet the demands for a working and living area. Event 6 describes all circular strategies found in Patch22.

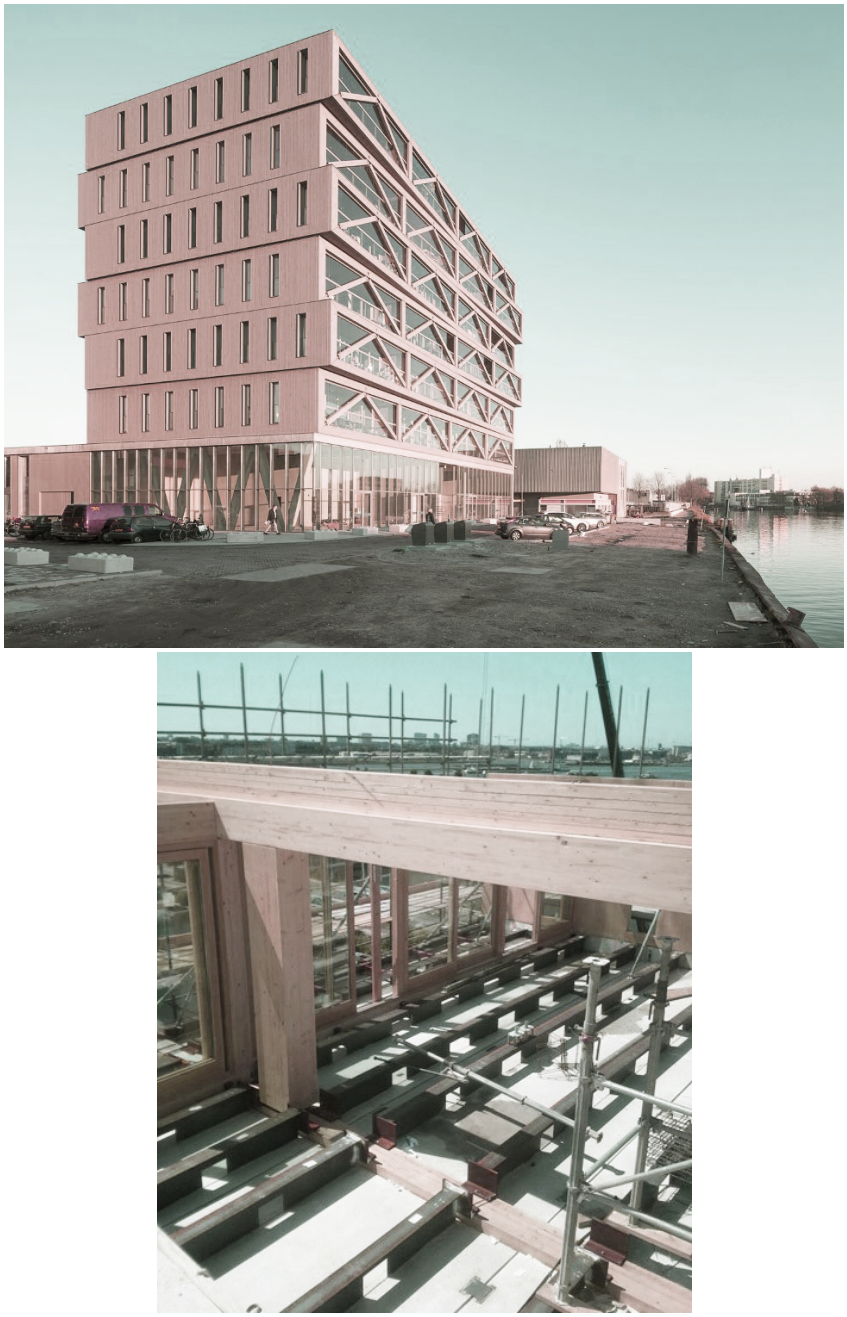


Figure 16: Patch22 finished and during construction (source: Patch22)

4.2.4 Bosrankstraat

Table 16: Characteristics Bosrankstraat

Bosrankstraat	
Issue	Lots issued October 2011
Completion	First houses in 2018
Function	Residential area
Design	Private commissioning
Prices	-
Involved interviewees	Inhabitant & architect KasHuis *Interviewee 6* Inhabitant & architect nr. 31 *Interviewee 7*

The Bosrankstraat was the first street in BSH issued for private commissioning. Eighteen lots were issued, and a total of fifteen residences were built. The lot issuing took place in 2011 at Zeeburgereiland in Amsterdam and candidates camped in line for three weeks to get a lot. The land was delivered ready for construction by the municipality in 2013. The development became possible after the first partial revision in the land use plan and exploitation decision (event D16).

Every building is different, which gives the street an incredible variation of architectural outlook. The residences are built individually. Two architects that created their own house are interviewed. They all implemented different circular strategies, but according to both interviewees, all residents constructed with a vision for sustainability. Some more than others, and most of them because of the favourable economic side effect (*Interviewee 7*).

Municipality

The land is leased to individual lot owners, by the municipality in the role of landowners. The facilitating public role is consisted of issuing an experimental permit for no connection to districting heating, in issuing grants via the menu scorecard and by facilitating a revision in the land use plan. The controlling role was by issuing standard permits.

The role of the municipality is viewed differently between the two interviewees. *Interviewee 6* says he needed the municipality by not standing in its way for his sustainable ambition. He does admit there was a lot possible but is sceptical as he claims all the innovative exceptions are not possible for developers nowadays. As an example, he calls the disconnection to district heating. Also, there are no new private commissioning projects on the planning. According to *Interviewees 8 and 9,* disconnecting with district heating is still possible in Buiksloterham, when projects can prove they have a more sustainable solution. Thereby he firmly believes rules and regulation are by definition defining the world of yesterday and are no good for sustainable innovations. *Interviewee 7* says “They were willing to think along, only sometimes file and knowledge building took a lot of time.” But is overall content with what he could achieve partly by the help of the municipality.

Circularity

An extraordinary circular project is the greenhouse residence (KasHuis) in figure 17. It entirely generates its energy by using passive and active sunlight (*Interviewee 6*). *Interviewee 7* says they were challenged by the municipality with a ‘menu scorecard’ for climate-neutral private

commissioning. It was not used as tender criteria like with the SchoonSchip project but used as a basis for providing grants. There were nine items to score on: (1) Insulation, (2) use of double/triple glass, (3) ventilation system, (4) central heating systems, (5) water heating, (6) water in (dish) washing machines (7) heat recovery shower water, (8) air-conditioning and (9) sustainable energy generation. A subsidy of 2500 or 3500 euro would be granted if 34 out of the maximum of 44 points were scored in the nine parts. The evaluation of the menu scorecard is described in the validation of the barriers. The circular strategies found in the interviews with two of the architects in the street are described in event 8.

Figure 17: Bosrankstraat and KasHuis (Source: Buiksloterham.nl and ARCAM)

4.3 Projects experiences in the process of Buiksloterham

The first developed project of the four is Patch22 (completed in 2014). When this project started, 'Circular' Buiksloterham did not exist yet. The economic crisis was in full swing, and Buiksloterham was a fallow and unpopular urban area. Sustainability was a way to put building projects on the map when the construction sector was in trouble. The developer of Patch22 had a small project-development firm, and because of the sustainable tender, he could compete with larger firms (*Interviewee* 4). The lack of demand is confirmed by both interviewees from Patch22 and Bosrankstraat, who bought their lots in 2011. The sustainable objectives that now fall under 'circular BSH' were by that time called an energy-neutral building or sustainable building. At the time SchoonSchip submitted their tender in 2013, circularity was an unknown concept. The tender document names circularity only once.

The municipality used a 'menu scorecard' as described in 4.2.4. All interviewees involved in development (architects/project developers) mention the menu. There was no integrated approach for 'circular' or sustainable development, the menu was used as a checklist in the tender for SchoonSchip and the issuing of lots in the Bosrankstraat. Bosrankstraat and SchoonSchip got subsidies with this approach. A negative side of using the menu scorecard was also seen in both projects. For example, points were given when underfloor or wall heating was applied in combination with heat pumps or city heating. KasHuis (Bosrankstraat) and some architects in SchoonSchip wanted to go further, by not using water pumps or city heating but just sunlight or no central heat at all. "I miss an integral approach for circularity as a whole" (*Interviewee* 1).

The ambition for a sustainable or energy-neutral building was extraordinary in SchoonSchip, De Ceuvel, the KasHuis Bosrankstraat and the architect of Patch22. It is found that the aspirations and plans were mainly citizen initiatives and came mostly because the participants of these projects were intrinsically motivated. The ambitions in the Bosrankstraat were not the same for every developer/inhabitant. The interviewee from the KasHuis states he was a lot further ahead in the field of sustainable development than some of his neighbours and especially the municipality (*Interviewee* 6). *Interviewee* 7 says that during the realisation of his house, he came to new initiatives. But in the beginning, he was mainly focussed on efficiency and costs. Both objectives let to more sustainable choices than business as usual.

During the construction of the projects, no policy decisions were made by the municipality that affected their construction phase. The only decision that is found concerning the projects is the increase in the land price. This affected the architect of Patch22 badly with his follow up project TopUP that he initiated himself. When he started with the project in 2015, the land price for his apartment was estimated at 940.000 euros. When they had to sign the leasehold contract in 2018, the land price was estimated at 9,8 million euros. Besides, "In the last three months of our development period, the municipality increased the lump sum payment until the end of the contract from 3.6 to 4.8 million. An increase of 47% in three months." (*Interviewee* 4). For project developers, increase in land prices is likely at the cost of implementing more expensive long-term investments that would result in more circularity. The developer (*Interviewee* 4) stated that the municipality puts its private role and interests above their sustainable ambitions, which is in their public role and interest.

Buiksloterham became an area the municipality is proud off, but the large bulk is yet to come (*Interviewee 1*). Around 7000 circular residences have yet to be built. If the opportunity is missed to upscale the strategies and innovations of the realised projects, it would be a massive waste according to the interviewees. It is a challenge, and according to *Interviewee 1, 3* and *7*, the municipality is eager but not always knows how to operate. It seems essential to get the large investors and project developers on board, as following the planning of Buiksloterham and the land use plan those are the upcoming projects.

4.3.1 Manifesto

The sustainable tenders of the municipality and the realisation of the projects because of these tenders gave a push in the right direction. But the architects and developers in BSH were missing an overarching sustainable masterplan or legally binding guidelines. In the total of documents and plans of BSH, strict circular guidelines are not found (only recently in the plans for the public space). The first document that is also signed by the municipality focussing mainly on circularity is the manifesto 'Circular Buiksloterham' (event D15). The manifesto was an initiative of the citizens in BSH. "We concluded a kind of covenant in which the municipality and other utility parties would commit to the circular objective" (*Interviewee 7*). All interviewees SchoonSchip, De Ceuvel and Bosrankstraat, were involved with the development of the manifesto.

In the opinion of the interviewees, the manifesto is very general. It started with a lot more specific and measurable conditions. But that appeared to be unfeasible. Now, the concept circular offers a lot of space for their own interpretation. This has led to the annoyance of the interviewees, and it is even said that now it might be wrongly used by parties for greenwashing (*Interviewee 5 and 6*). "The communication factor is greater than the real yield." (*Interviewee 3*). It is seen as a good start, but it is not legally binding. And the lack of legally binding rules to implement circular strategies, in the manifesto but also overall, leads to frustration for five out of seven interviewees. "If there is no action in policy documents etcetera, even if everyone we are working with is great, it feels like they say 'nice that you had your little boys playground', but now severe people are coming, and they will do it according to their standard. There is money on the table now, so you have to back off." (*Interviewee 7*).

The effect of signing the manifesto as municipality seems still limited. *Interviewee 4* says he tried to use the manifesto to convince the municipality to let him implement some circular strategies (flexible apartments, as a service elevator) but it did not affect. "You can have all the ideas in the world, but if you cannot maintain it, it is of no use." (*Interviewee 1*).

4.3.2 Circular Buiksloterham today

The interviewees are asked what they think of calling Buiksloterham a circular UAD. While the interviewees were, despite some critical notes (that are presented as barriers in 5.2.3), overall positive of the role during their projects, the interviewees were mostly negative on the current role they play in circular Buiksloterham. The responses of interviewees on the question: What do you think of the circular vision of the municipality for UAD Buiksloterham? go from "extremely bad" (*interviewee 2*) to "just a political matter" (*Interviewee 5*).

Table 21 in Appendix IV summarises the opinion of the interviewees, which is for 'circular' BSH mostly negative. The following points sum up the criticism. When the points include barriers, they are validated and discussed further in paragraph 5.2.

1. Six out of seven of the interviewees have the feeling the policy of the municipality has changed. BSH used to be a non-economic area when they arrived, where new citizens could pioneer and got a lot of room to experiment from the municipality. But BSH is becoming a more and more attractive area for large project developers, partly because this area is becoming more attractive to live and due to the great scarcity on the housing market. The municipality can now earn a with higher land prices, and that attracts project developers that do not take circularity above the legally required minimum.

2. In times of crisis, there was a little demand for new construction of homes. To attract developers, private commissioning projects and sustainable tenders came. In March 2020, just before the start of the global corona crisis, the demand for housing is high, and the house and land prices are very high. The need for a project to stand out on sustainability is lower. This runs counter to the growing ambitions for sustainability and circular development by the municipality. Local citizens that execute (collective) private commissioning projects will always have an intrinsic motivation for proper development of the area (*Interviewee 1, 3, 6 and 7*). Inside the plans for the future of BSH, no new private commissioning projects are planned.

3. Both reasons explaining the frustration of the interviewees on new project developers in BSH and the way the municipality attracts them is further fuelled by the new investment decision. There is a reduction of 28% for office space and a growth of 114% for dwellings.

4. In addition, the interviewees are concerned with the absence of legal instruments to enforce circularity. Big project developing companies have enough lawyers to argue they follow the building decree or land use plan (*Interviewee 3 and 7*). *Interviewee 1* mentions he is afraid a lot of greenwashing happens by large project developing companies. "Saying that they will make a sustainable building, and then buying and shipping the wood from Eastern Europe" (*Interviewee 1*).

5. The municipality offers participation projects. "When we wanted to talk about Buiksloterham's vision on what is really circular and what is really green, the municipality refused to engage in a conversation" (*Interviewee 2*). The inhabitants get the feeling they are supposed to colour something in the framework of the municipality. They seem to have no use in real participation when they come with ideas. The area is full of sustainability professionals and architects, that are almost offended when they are asked to participate but then in practice don't get the opportunity. Also, "during the participation sessions, we got accompanied by a process madam of the municipality that had zero substantive say or knowledge on the cases."

6. *Interviewee 4* wrote a letter to counsellor' sustainability.' He expressed his concerns that with the current regulation, project developers like him are opposed by the land affairs department when implementing circular strategies. He claims he got a letter back from the councillor of land affairs explaining to him how the ground regulation works in Amsterdam. There is no separate department for sustainability, and an integrated approach between

the public and private departments lacks. Even more frustrating for him, the councillor had the department of Grondzaken (land affairs) and Duurzaamheid (sustainability) in one portfolio.

7. Experiments that took place in the analysed projects need evaluation to upscale. The feeling after the interviews is that little is measured and/or analysed by the municipality. As a result, there is a risk that the circular strategies that they encourage or wish for in circular BSH stay limited to trials.

8. Inhabitants of Patch22, representing inhabitants that have not developed a project in BSH, are found to be not involved in the vision of circular BSH. There is no easy access to information for the new projects in the area. “When I try to google what is about to be built on the other side of my street, I cannot find anything” (*Interviewee 5*). In addition, “When you drive in this neighbourhood, you see six Kwantums (hardware stores) and not a single supermarket, let alone a sustainable one” (*Interviewee 5*).

5. Circular strategies

Part of the aim of this research is to find what circular strategies are implemented in the UAD Buiksloterham. To get a realistic view of the area, four subcases with the highest circular ambitions are chosen as representation. The interviewees of the subcases are asked if they could place the implemented circular strategies in their project in the theoretical framework of this research. The circular strategies that are found in the interviews are added to the list of events (Appendix II). There the total of practical aims per case can be found. Table 17 in section 5.1 presents the practical aims per theory strategy to give an overview of all strategies found in Buiksloterham. The strategies will be briefly discussed per aspects of their content and potential for upscaling.

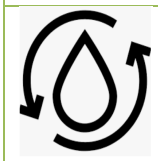
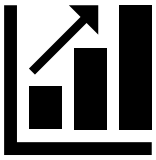
A following question for the interviewees was if they used strategies that they could not place in the framework. The results of these questions are presented 5.1.2. Also, the interviewees are asked if they faced barriers when implementing circular strategies (5.2). Together with the barriers in section 4.3, the total of barriers is discussed in interviews with municipal officials. The officials were involved as sustainability advisers during the realisation of the cases in Buiksloterham.

5.1 Practical aims of circular strategies

The strategies that are found in BSH are summarised in the following table.

Table 17: Circular strategies in Buiksloterham

Aspect	Theory strategy	Practical strategy
Energy	1. Closed energy system	- Jouliette - Local and interchangeable energy generation with only one general connection to the energy grid - Efficient use of energy, reduction - Insulation - Greenhouse house - Energy neutral building
	2. Use of sustainable energy resources	- PV-panels - Heating with local water pumps in canal - Energy storage batteries - CO2 neutral pellet heaters
Materials	**3. Closed biological cycles**	- Struvite reactor for filtering urine - Dry compost toilets - Vacuum toilets - Grey water system
	4. Closed technical materials cycles	- Wood as (main) construction material - Biobased construction materials

	5. High quality reuse of materials	- Reuse of offices, scaffolding and wood
 *Water*	6. Closed water system	- New sanitation system with generating biogas via a system of vacuum toilets
 *Economy*	7. Service economy	- Sharing office spaces - Local mobility as a service project - Plans for elevator as a service in high-rise construction
	8. Businessmodel innovation as key for industry transformation	- Plans for pilot using solar energy as currency - New ownership layers for easier implementation of circular objectives - Greenhouse house experiment as concept for standard housing
	9. Use of potential cost, risk and diversification for value creation	- Long term investment in energy systems - Crowdfunding for new circular experiments
	10. Central role is in private business due to resources and capabilities	- Solution for the fallow polluted soil is found in the market - CPO projects - Private commissioning streets (zelfbouw)
 *Nature*	11. Non-economic building principles inspired by nature	- Cleaning of polluted soil by plants - Aquaponic system - Biobased products and materials in construction - Greenhouse building using active and passive solar energy
 *Digital technology*	12. Use of digital technology for virtualisation	- Technology that shows and keeps track of the energy generation and consumption per lot - CO2 meter that automatically ventilates - Design of the Greenhouse-residence in Archicad 3D
 *Design*	13. Design for disassembly and flexibility	- Modular office buildings without foundation - Build on water - No load-bearing facades and removable main load-bearing structures - Adjustable floors - Layout meets demands for office and living space

		- Hollow floors and ceilings for flexible changing of pipes and shafts
	14. Coexisting pathways of development	- Creating of a community between induvial with same circularity goals
 *Scales*	15. Operate circular principles at all scales	-
 *Stakeholders*	16. Intra and intergenerational commitments	- Leaving soil cleaner than before lease - Regenerative designs based on the thought that future generations can live in the same building
	17. Cooperation of different stakeholders	- Experiment of Jouliette in cooperation with Alliander - Experiment of energygrid together with Westpoort Warmte - Experiment of toilet system with Nieuwe Sanitatie of Waternet
 *Regulation and incentives*	18. Regulation and incentives as core implementation tools	- Menu scorecard - Subsidies of the municipality - Legally binding commitments in tender criteria
 *Research*	19. Make use of a multi- and interdisciplinary research field	- Use of multi and interdisciplinary research fields

1. Energy

SchoonSchip got an experimental permit to design a smart-grid in the village. Every house has large battery storage. They generate energy locally together and the division of energy is monitored with digital technology. The system operates perfectly according to *Interviewees 1,2 and 3* and all generated energy comes from sustainable resources. Ideally, this smart-grid is upscaled to more areas in Buiksloterham. For emergencies, there remains one connection to the main grid.

The EPC (energy performance indicator) in all four projects is much lower than the legal maximum, due to sustainable and better use of the energy and to good insulation. Some houses in the Bosrankstraat do not have a connection to the main grid. If the EPC is lower than 0.15 you can deviate from the standard connection in Buiksloterham (*Interviewee 8)*, so there are possibilities within the law and regulation.

Under the name ‘Jouliette’ a test is going with new technology for exchange of locally generated energy. The ambition is to make a local digital trading platform. This project is done in collaboration with network operator Liander and SchoonSchip.

2. Materials

Both theoretical material strategies “Closed material cycle” and “High-quality reuse of materials” seemed interlinked in practice. Re-using materials is part of closing a materials loop. After discussing the framework with all interviewees, it is found that a better categorisation would have been to split up the ‘closed material system’ into a technical closed material system and closed biological cycles. This categorisation is added to the framework.

De Ceuvel designed almost all tangible parts from used materials. In SchoonSchip and Bosrankstraat the interviewees acknowledge building with reused materials. The choice between new or reused was often that new materials last longer. Some innovative sustainable options (like window frames for triple glass) are not available second hand.

a. Technical closed material system

Includes the use of wood or bio-based materials for construction

b. Closed biological cycles

The pilot of ‘Nieuwe Sanitatie’ in SchoonSchip makes use of a new sewing system with vacuum toilets. The human excrement can be upcycled to fertiliser or biogas. The system is not in working yet and some barriers were found like the sinking of the fermentation boat. *Interviewee 8 and 9* of the Municipality both acknowledge that all stakeholders involved are working hard to get the pilot up and running.

De Ceuvel uses a different system to close the cycle for nutrients coming from human excrement. The toilets are ‘dry compost toilets’, turning excrement into fertiliser. A struvite reactor extracts phosphorus from the urine coming from the men’s room in the café. Project Nieuwe Sanitatie seems more suitable for implementation in the bigger scale.

3. Water

All projects have invested in a greywater circuit. Some in combination with the collection of rainwater. The municipality stimulates these projects (*Interviewee 8 and 9)*. The local production of drinking water is discussed as a barrier. The Bosrankstraat does not use a lot of innovations regarding water.

Water cycling appears to be interconnected with strategies for energy and materials. For example, the biogas from wastewater in ‘Nieuwe Sanitatie’ and the nutrients from greywater and urine. A fully closed water system is not found in any of the projects, but the aim to use water resourcefully and reuse it when possible is.

4. Economy

Service economy is found in the MAAS-system of SchoonSchip. Ideally, this system would operate in the whole area. Patch22 planned to realise an elevator as a service with Mitsubitsu, users would buy the utilisation. It was not possible due to the building decree that says all shared facilities of the apartment should be owned by the VVE.

The business model Joulliete by De Ceuvel in collaboration with SchoonSchip is a novel. The idea is that you can buy drinks etcetera at the Café paying with locally generated energy. This can be scaled up if more houses connect to the smart grid of SchoonSchip. The greenhouse house was built and designed for standardisation as a new business model, but according to Lindner there was no demand in the market.

Strategy 8, 9 and 10 were all found difficult to interpret. Some practical aims are found after explaining some background from the theory of Geissdoerfer et al. (2017). Value creation was done by having a lower EPC so less costs for energy, same as for water and materials when reusing, but all are long term investments. For SchoonSchip some crowdfunding takes place to pioneer new sustainable projects.

5. Nature

The interviewees found it difficult what would fall under this strategy. The strategy is about including nature in design and building. Biomimicry is not used in any project, but natural products and working with nature is. The cleaning of the soil might be an idea for the other fallow areas in BSH.

6. Digital technology

The use of technology and the number of technology features are different in every development. A collective tool in SchoonSchip is the technology that keeps track of the energy generation and consumption of the individual houses. It stimulates a deliberate consumption of energy and more importantly, you can sell to your neighbours what you don't use.

7. Design

All interviewees claim to use the theory for designing modular, flexible and for disassembly. Design for flexibility was the main aim of Patch22. Hollow floors and ceilings had to make it possible to change the location of the bathroom, kitchen etc. Also, the layout meets the demands for working space and living space. There were some setbacks. "Unfortunately, that little group of criminals that were the contractors ruined those plans by building steel profiles everywhere, which now make it impossible to ever come under the floor to make changes in the piping etc." (*Interviewee 5*).

8. Scales

The strategy of implementing circular principles at all scales is not found in the cases. Their strategies do not operate on another scale than their building/village. The familiar scales are the micro (components), meso (buildings) and macro (city) scale. The projects in Buiksloterham lie between the meso and macro scale. The strategies do not interact between different scales.

9. Stakeholders

SchoonSchip and De Ceuvel initiated circular experiments with utility parties. Utility parties have a great role in implementing circular strategies, they are for example responsible for the water and energy supply and need to be included when deviating from a standard connection. Other important stakeholders that worked together are knowledge institutions, users/residents and interest groups. Patch22 and De Ceuvel say they kept intergenerational commitment in mind when designing, focussing on the demand of future generations.

10. Regulation

Interviewee 6 strongly disbelieves in the use of regulation and incentives: *"*Regulations define, when they are written, always by definition the world of yesterday. That does not fit a pioneer." Also, *interviewee 1 and 3* are critical, for example the EPC calculation: "If I insulated my house with mercury, I would have a low EPC and it would not have consequences for the subsidies/grants" (*Interviewee 3*). The strategy *"Regulation and incentives as core implementation tools"* is therefore debatable. It strongly depends on what the regulation and incentives are. In practice, it is found that for project developers strictly following the minimal requirements of the building decree, regulations can lead to more sustainable solutions. Besides, tendering on sustainability criteria makes that developers must stand out in terms of sustainability to win the tender. But the current regulations and incentives do not fit a pioneer in Buiksloterham.

11. Research

Research is done by individuals of SchoonSchip and Bosrankstraat. It is a requirement to make the right trade-offs, but it is very time-consuming. (*Interviewee 3 and 7*). SchoonSchip puts all its research and knowledge online. They put their data and experiences in open-source documents.

5.1.1 Reflection of the strategies

The list is used to identify, structure and reflect upon circular strategies in Buiksloterham. It is designed for the built environment, including urban area development. The identified strategies in the table summarise the total of circular strategies that are found in this research in Buiksloterham. The strategies were drawn up differently. In the cases, the interviewees appear to have a high intrinsic motivation for sustainable and circular development. They argue that they have implemented more strategies than the required minimum of the municipality. This inherent motivation has led to most of the strategies in De Ceuvel and the Bosrankstraat. In SchoonSchip and Patch22, most of their strategies were established in their tender. The municipality had set specific requirements for sustainability via the bid but gave the market an incentive to go further by awarding on sustainability criteria. The municipality controls if Patch22 and SchoonSchip follow up their tender promises. Because a lot of strategies were new for the municipality a lot of barriers and delays appeared (5.3.3).

The projects have passed a lot of procedures with the municipality. Experimental permits are established via the 'crisis and recovery' law, new ideas as the smart-grid and the MAAS model are developed, and new circular initiatives have become standard city-wide, like the possibility to disconnect with district-heating. The developers have spent an average of seven years (SchoonSchip even ten) realising where they are now. This knowledge can be of great value for new developers and for the public space in Buiksloterham. Besides, one of the strategies is making use of international and multi-disciplinaries research fields. Not making use of each other's research for development in the same area is a waste.

The municipality should evaluate and take lessons learned from the developments in BSH. After assessing the strategies as successful, they can facilitate that new developers use the knowledge of the current developers. It is important not to make it mandatory, but to offer help if the same strategy is appropriate. This list of strategies can be a handle for the municipality. Not only does the municipality have experience with the application and procedures, which can save time. But also does this generates time-saving possibilities for the developers. They

don't have to invent the wheel themselves every project, if they do not want to or have difficulties with implementing circularity. Besides, implementing current working strategies on a larger scale will lead to a system change and a new system perspective. This contributes to a circular urban area instead of separate circular projects or a sum of circular strategies in a neighbourhood. Strategies that appear to be suitable for evaluation and upscaling for the municipality in this research are: Jouliette, Smart grid, 'Nieuwe sanitatie with vacuum toilets', wood as main construction material, MAAS-project, cleaning of polluted soil by plants, building on water, flexible designs, use of multi and interdisciplinary research fields.

5.1.2 Missing strategies

The interviewees are asked if they had strategies that they could not fit in the framework.

1. *Use of bio-based materials or materials that are in the future easy to reuse.*
   For example, the wooden construction in Patch22. Wood is a much more sustainable construction material than concrete (Lipkke et al., 2004). But because it is 'new' wood or 'new' bio-based materials that are used in the projects, it did not fit the strategies as presented in the framework in paragraph 2.3 table 6. The new list of strategies in table 17 takes the bio-based materials into account.

2. *Lack of social strategies.*
   According to *interviewee 6,* social dialogue is the absolute key for a sustainable solution, and not the technique. Besides, it is noted by interviewees that the framework does not elaborate on social strategies. This is a common discussion point in the literature on circular economy and sustainable development. Paragraph 7.1 will reflect further on this topic.

3. *Involving inhabitants in the design and maintenance of public space.*
   Locals seem to have a great interest in a healthy and green area and according to the interviewees are willing to invest time in the public space. The did a project with the neighbours to design the green in their street (*Interviewee 6 and 7*). In addition to adding 'green' to the area, the social part of the project stimulated sustainability and knowledge sharing. This can also be indicated as a social strategy. Paragraph 7.1 reflects on the lack of social strategies in the framework.

5.2 Barriers for circular urban area development

As briefly discussed in section 1.1.1, circular economy encounters barriers of financial, sectoral, cultural and regulatory nature (Hart et al. 2019). If barriers can be bypassed or dismantled, the better the progress towards a circular economy will be (Hart et al. 2019). As so for Buiksloterham. Regulatory barriers are interesting for the municipality of Amsterdam, who is (together with the provinces and the national government) the executive body of the laws and regulation. Regulatory barriers concern the policy and regulatory environment in general and for specific cases (Hart et al. 2019). Law and regulations are to realise equality in humankind, and on a smaller scale in the built environment to have equal living possibilities for everyone. But therefore, it can conflict with innovations and pioneers. As Buiksloterham is a designated area for pioneers with new projects, it can be explained that most of the barriers found in the projects are regulatory barriers. The other barriers in the built environment found by Hart et al. (2019) can be summarised as follows. Financial barriers are financial issues and are concerned with the market—for example, high upfront investment costs, capital expenditure over operational expenditure and limited funding. Sectorial barriers are the

barriers directly applicable to the built environment, as design complexities, technical challenges regarding material recovery, lacking standardisation and the fact that the sector itself may be conservative, uncollaborative or adversarial. Cultural barriers concern a lack of interest, knowledge and engagement throughout the value chain.

The interviewees are asked what barriers they ran into while implementing circular strategies. The barriers found bottom-up in the interviews are subdivided under the four natures of barriers by Hart et al. (2019). The barriers that were, according to the interviewees, (partly) caused by a role of the municipality are discussed with two municipal officials (top-down). Not only regulatory barriers are linked to the municipality. The municipal officials that were interviewed are the circularity advisors in Buiksloterham during the realisation of all the four projects. The circularity advisors are asked (1) if they recognise the barriers, (2) what can be done with the barriers from without the municipality (top-down) and (3) by the developers who found the barriers (bottom-up). The municipal officials reflect upon the barriers from the perspective of the municipality.

5.2.1 Regulatory barriers

1. Apartment rights

   To make sustainable apartments in a loft, not only the design must be flexible but also the legal aspects must make it possible to have a flexible apartment. Patch22 is designed to use areas interchangeable for work and living and with a possibility to combine and split up apartments in the future. Due to the current regulation for apartment rights, this is very difficult. Apartment rights are fixed for several square meters.

   Flexible design and construction are a focus point of the municipality (*Interviewee 8 and 9*). Apartment rights are linked to the leasehold arrangement. It is possible to change a leasehold arrangement, but in the experience of *Interviewee 8* participants don't come through because they are afraid for revaluation of the leasehold. This might underline that the leasehold system as a whole is not flexible, as the flexible building is not a standard (*Interviewee 8)*. It is important that with the new plans for work/living and circular ambitions flexible designs become standard. However, changing the apartment rights regulation is a large procedure. The department of land affairs is responsible for leasehold arrangements and apartments rights. As the reason that the barrier is not yet dismantled, *Interviewee 9* says it is not a problem yet, so there is no concrete example for the department of land affairs. If the municipality does not take this seriously, it may become an irreversible problem in the future what will be a waste for circularity.

2. Land value calculation

   The price of land is calculated by the municipality as market *value minus foundation costs.* The foundation costs are fixed following the building decree. If the real foundation costs are higher because the circular materials cost more, you make a loss. The solution for the higher costs according to the municipality was to earn it back as higher market value (sell the apartments for a higher price). A concrete example that was given by *interviewee 4*: A skeleton of wood costs 1.6 million euros and a concrete one 800.000 euros. First, you pay 800.000 euros extra to the wood supplier; then you pay it in extra because it is not added in the foundation costs. Because it is calculated as additional market value, the wooden skeleton became three times more expensive than a standard concrete one. The developer of Patch22 takes on every platform to bring this story to the outside world.

Sometimes a customised calculation for the foundation costs is made, but this appeared to be not possible for Patch22. A customised estimate nowadays is happening more often (*Interviewee 9*). Generally, with a tender, the extra costs for the promised quality are for the bidder, compensated by the price of the land. In the case of TopUp (the follow-up project of the architect of Patch22) there was no tender. There always is a wright/wrong discussion about the price of land between the developer and the department of land affairs (*Interviewee 8/9)*. It is essential that when the market value goes up because of sustainability, it should be deducted in other variables (*Interviewee 8*). Sustainable development is not always coming back in the calculation methods (*Interviewee 8*). This is a significant barrier for project developers. A counterargument from the municipality is the lack of support for this barrier from other developers. For example, developers in lot 20E openly said that the operating costs of wood should not have to be that much higher like in the case of Patch22 and TopUP (*Interviewee 9).* The department of Land Affairs and both municipal officers say that in new situations it has not happened again (yet). They have to monitor this with comparable projects in Buiksloterham and other areas. The loss of face that Patch22 creates for the municipality must be taken seriously.

3. No permit for local generation of drinking water
   To close the water cycle, De Ceuvel has its own water treatment plant that delivered approved water quality (by Waternet). They cannot use the water for their offices and café as there is no permit for non-water treatment companies to use their water.

   Quality and permits for drinking water are the responsibility of the National Government (NG). The municipality is now committed to the reuse of rainwater in greywater and the greywater circuit, but not on the reuse of water for drinking and personal care (*Interviewee 8)*. This mainly has to do with the yield (environmentally) versus what it costs to implement this (*Interviewee 8 and 9*). The barrier is understandable, as it has everything to do with circularity, but it has too many risks according to the municipal officials. They see possibilities for the future, but it is not a priority at the moment.

4. No integral approach for the measurement of circularity
   The municipality used a menu scorecard for the tenders and for subsidies. An integral approach is missed for the measurement of circularity. With the menu scorecard, the circular strategies were individually rated, instead of the project as a whole. In addition, in the menu scorecard a lot of the strategies were technical solutions. A technical driven approach can be costly and not always makes the project better according to *Interviewee 1*. “Low-tech was not an option with the menu scorecard, while no heating is more sustainable than heat pumps.” (*Interviewee 1*).

   The integral approach that is asked for is time-consuming. Especially in the case of SchoonSchip, that is why the municipality asked for a combined bid of all lots. When they asked for different hulls with different insulation etc. the municipality blocked this. According to the circularity advisors, it is a balance between the added time and the added value. *Interviewee 8* underlines he is technically skilled, as most municipal officials in his position. No heating is even with the best insulation not possible in the Netherlands, ‘if we accept that then heat will come in the winter from wood stoves or electric heaters’ (*Interviewee 8).* The demand for customisation is understandable and in line with the ideas

of a circular operating building. The municipality aims for more customised options in the future. The menu scorecard is already a lot further developed asking more for a concept and a vision in tenders now. There is not scoring anymore but customised measurements agreements. It can be concluded that in Buiksloterham, they are developing a more integrated approach for the measurement of circularity. Still, it does not yet fully meet the needs of the developers. Therefore, the municipality must learn from the project and evaluate their measurement methods often.

5. Building Decree
   The building decree is called a barrier twice. A concrete example was the strict rules for the fuse box. At the same time, the designer wanted to deliver only the airframe of the apartments to have a design appropriate for working and living (*Interviewee* 4). The second time was by *Interviewee* 6, saying that sustainable insulation material leads to thicker walls. This means less inner space with the same GFA (Dutch: BVO).

   The municipal officials are both aware of the complications with the Building Decree. The Building Decree is the responsibility of the National Government (NG). The municipality occasionally discusses issues due to the Building Decree with the NG when they ran into concrete examples from bottom up. Buiksloterham gets an environmental plan by 2021 that will substitute the current Land Use plan from 2009. That will offer more room for innovations. For the insulation, the reasoning is that the market value goes up, so you are not 'punished' for better insulation. Also, *Interviewee 8* acknowledges that for an RC 10, some extra space is used, but it is generally one or two centimetres per wall. Delivering the building 'airframe' only by Patch22 was against the agreements in the tender, that stated that the apartments would be equipped with biomass boilers. Rules as for the fuse box are often because of the expertise of the utility parties (Liander in the case of Buiksloterham). An experimental permit can be issued when parties want to deviate from the building decree. Also, the article 19 procedure makes it possible to deviate from the land-use plan. The building decree needs thorough analysis in the suitability for circular construction.

6. No legal jurisdiction for implementing circularity in BSH
   The interviewees give the lack of legal jurisdiction as the reason that there are not more circular projects going on in BSH at the moment. The manifest has no legal basis. Higher legal requirements will lead to more sustainability and circularity, according to the interviewees.

   As discussed before, the municipality is owner of 1/3 of the ground in Buiksloterham. Here they do have legal jurisdiction when they issue the projects and lots via tenders. In the bids, implementations regarding circularity are going well, the municipality checks the fulfilments of the promises and ambitions (*Interviewee 8 and 9*). In the other 2/3 of the area, the interviewees acknowledge this barrier. Developers in those 2/3 fall back on concrete construction, for example. The reason for this is the whole chain of concrete builders who have their own interests and revenue builders. The area does attract new people, and the municipality tries to stimulate this. The legal jurisdiction question is complex and on the national level or even European.

5.2.2 Financial Barriers

7. Land price increasing

   The land price increase is named as a barrier in two different discussions. For the project developer of the high-rise apartment, the land price increase happened in a late phase of their construction. To keep a profitable project, he had to reduce his circularity ambitions *(Interviewee 4*). Two other interviewees who mentioned the land price increase are concerned about what type of project developers will be attracted to the area. They fear developers that care more about quick profits than long term circular investments.

   The land price increase is mainly out of the scope for the sustainability advisors in the projects. What happened with *Interviewee* 4 is part of the growing economy and high scarcity in the housing market. It happened during the TopUp project and was possible because there was no tender agreement. The municipality established additional performance indicators like MPG- (environmental performance) and EPC-values (energy performance), to make sure the new developers take circularity serious. There is an upward trend in what the municipality can enforce, to guarantee the essential quality. Research must be conducted into the possibility of keeping land prices low for circular projects.

5.2.3 Cultural barriers

8. Lack of knowledge by contractors

   In Patch22, contractors “ruined” the flexibility part (*Interviewee 5*). Because of their lack of knowledge or interest for constructing the flexible design. They placed steel profiles, which now make it impossible to ever come under the floor to make changes in the pipes etc. Besides, within the private commissioning, lots of people are “screwed by the contractors” *(Interviewee 2*). They were supposed to build sustainable, but in practice, according to *interviewee 2* they used toxic glue and other not at all sustainable solutions.

   As circularity and building with flexible designs is a relatively new concept, lack of knowledge is an understandable barrier. Sometimes it appears it is not the lack of knowledge, but contractors, architects or developers trying to earn their part in projects. This is seen at every layer in a project and is in the end at the cost of sustainability (*Interviewee 8 and 9*). The market needs to be challenged more. If circular strategies become the standard there may be competition on other things. Lack of knowledge, or participants who run the distance is something of all ages though (*Interviewee 8*). The municipality tries to stimulate the market where they can (*Interviewee 9*).

9. Contact with the municipality

   The municipality’s project leader changed very often during the realisation of SchoonSchip (six times in ten years). This led to a lot of additional knowledge exchanges and disagreements. It caused that decisions that were first accepted, were rejected after a change in project leader (*Interviewee 1).* Also, a separate department for sustainability in private construction parts was missing (*Interviewee 4 and 6)*. The councillor had by that time Grondzaken (land affairs) and Duurzaamheid (sustainability) in one portfolio. According to *Interviewee 4* these two departments conflicted.

During the realisation of SchoonSchip, there were several problems with the project leader that was an exception in this case. An average, there should have been someone on the position for about five years (*Interviewee 9*). *Interviewee 8* has been responsible for sustainability measuring in Buiksloterham since 2009, so that point of contact has been constant. The sustainability experts and department has grown more significant in the last years. In Buiksloterham is a whole team of sustainability experts. There also is a sustainability department (Ruimte en Duurzaamheid) in the municipality. This department is not directly linked to the specific projects and questions and requests for sustainability take long. If the circularity advisors in Buiksloterham agree on the current structure, they have to inform the developers better on the contact points. It is a waste if strategies cannot continue because of the lengthy procedures or wrong contact points. It is up to the municipality to fill this information gap.

5.2.4 Sectorial barriers

10. Sinking of the boat for the new sanitation experiment

    It is a setback for strategy 'Nieuwe Sanitatie' with the vacuum toilets in SchoonSchip. It is a complex and very unique project that tries to break a barrier with technical challenges regarding material recovery. A new boat is delivered now without any additional costs for the inhabitants. It is essential to analyse what happened with the old boat. Also, the responsibilities of the ownership and maintenance must be clear, so there will be no discussion about it in the future.

11. Waste separation

    There are not enough possibilities for waste separation in Buiksloterham, but also in the city (*Interviewee 3 and 7*). The interviewees have questions about the current waste recycling policy in Amsterdam. The municipality is responsible for the supply of containers for waste separation and the recycling system in Amsterdam.

    It is a familiar problem for the circularity advisors. They strongly agree that this barrier needs to be dismantled. It is complicated, according to *interviewee**s** 8 and 9*. The current policy in Amsterdam is to separate waste collection in five fractions. Buiksloterham is aiming at six, including a separate group for organic waste (Dutch: GFT). Buiksloterham is depended on the central waste collection of Amsterdam. The central waste collection of Amsterdam needs a recalibration. As Buiksloterham is a pioneer, the project team can put pressure on the city. In line with the ambitions of the municipality, the waste separation problem must become a priority.

    An experiment is in the making with collecting organic waste via grinders in the sink, to reuse it locally (*Interviewee 8*). It shows the municipality is busy finding solutions for this barrier. Besides, the municipality plans to reuse materials from and within public space, with a digital and local hub. The pilot will be in Buiksloterham.

6. Case study reflection

This chapter reflects on the results of the case study. It answers the question: How are circular projects developed in Buiksloterham, and what role does the municipality play in the development? First, the involvement and roles of the municipality will be reflected, and second the development of circularity.

6.1 The role of the municipality in circular Buiksloterham

Buiksloterham has a program for approximately 8575 homes. A sharp increase since the first zoning plan in 2009, partly thanks to the municipalities designation of Buiksloterham as acceleration and densification location in 'Koers 2025 (D23)'. Around 7000 houses still have to be built. Within the area, space has been provided for sustainable initiatives instead of business as usual urban area development. This is started with the first sustainable tenders the municipality of Amsterdam wrote in 2009. Circularity was by that time still an unknown principle; the projects were focused on energy and climate neutral. Allowing private commissioning, offering space and permits for SchoonSchip and launching a competition on the contaminated soil has continued this trend. SchoonSchip was a citizen's initiative. For the other projects, the municipality provided incentives for sustainable development. The increase of sustainable projects in the area with intrinsically motivated inhabitants and the top-down plans for a Circular Economy in Amsterdam (fuelled by European decisions), led to a manifesto for 'circular Buiksloterham' signed (as well) by the municipality. Buiksloterham comes forward in the publication of the plans by the municipality for a Circular Buiksloterham, as a pioneer and leader for circular urban area development in Buiksloterham. It can be concluded that Buiksloterham is an area the city is proud of, as they put a lot of attention and publicity on Buiksloterham.

The municipality interacted in different roles. It is found that all projects had a lot to do with the municipality in the private role executed by the department of land affairs, not only as establisher of the land price but also regarding sustainability. Implementing circular strategies affects the market value and foundation costs, which leads to the calculation of the land price. The leasehold system of the municipality seems to block circularity. The interviewees appeared to make no distinction between the private and public role, when talking about the municipality. Especially within the case Patch22 the municipality as a whole is blamed for the problems that arose. There is a shared feeling between the interviewees that the city has a double agenda. This is because of the significant earnings of the increasing land price, what according to them block circular initiatives.

Two municipal officials executing the role of sustainability advisors in BSH are asked about their involvement and the roles of the municipality during the projects. They have both been involved with the public roles since the start in 2009. The facilitating role during the projects is acknowledged and gratefully responded to by the interviewees. There was room for experiments and experimental permits. Also, the initiating role for project De Ceuvel is bottom-up seen as a successful plan. The controlling role is taken very seriously in Buiksloterham, according to *Interviewee 8 and 9*. They state that at the moment, sustainability and circular

development is a top priority in Buiksloterham. This is not in line with the interviewees who have a lot of critic on the current circular progress in Buiksloterham.

There is no consensus about a positive or negative involvement of the municipality during the projects. Within three of the four cases, the interviewees are mostly positive. In one case, the interviewees were negative. It is found that in that case (Patch22) the problems were mainly with the land affairs department. The municipal officials executing the public roles in Buiksloterham understand the issues. They do not have complete knowledge of what is going on in the department of land affairs (*Interviewee 9*). Still, they do say they have seen the department is willing for changes if it results in circular development. This is contrary to the experience of Patch22. In both of the above issues, the municipality has a different perception than the developers.

There is consensus between the interviewees about the role during the realisation of Buiksloterham as circular urban area development. All interviewees are mainly critical (Appendix IV, table 22). The criticism lies in the attraction (by actions of the municipality) of large private investors and developers, that will likely not have an intrinsic motivation for circularity. Besides, the recalibration of the investment decisions and land use plan has to little room for green and not enough obligations for developers. Also, a lot of participants in the four projects are specialised is circular construction, sustainability and architecture. They don't feel heard, and the participation events of the municipality made things worse. There also is a concern that the pilots in the projects are not evaluated and measured. As a result, insufficient use is made of the knowledge that is already available in the neighbourhood.

6.2 Circular strategies in Buiksloterham

The theoretical framework is used as a handle to identify, structure and reflect upon the practical strategies. The case study led to an extra strategy in the framework. The circular strategies are analysed for their potential to upscale, as the main aim of this research is to find how the municipality can upscale circular UAD. Strategies that are found suitable for upscaling are: Jouliette, Smart grid, 'Nieuwe sanitatie with vacuum toilets', wood as main construction material, MAAS-project, cleaning of polluted soil by plants, building on water, flexible designs, use of multi and interdisciplinary research fields. The municipality should evaluate and take lessons learned from the implementation and progress of these strategies. Some of these strategies are at an early stage and need more improvement and evaluation first. These strategies contribute to the development of a circular UAD. They are deemed suitable, as there are no barriers or easy to dismantle barriers found. Besides, the case study points out, the users are satisfied.

What the four projects have in common is the fundamental motivation of the developers to implement circularity and sustainability. They did not choose directly for circular development because of the incentives of the municipality, but they had the benefit that the municipality tendered on sustainability criteria. The use of a checklist (the menu scorecard) in tenders or subsidies is criticised. A more integrated approach for measuring circularity is wishful.

The municipal officials recognise a lot of the barriers. Based on the interviews, it can be concluded that the project team of the municipality within Buiksloterham is eager to implement circularity. Unfortunately for all parties, some barriers are outside the scope of the team. These barriers are linked to the organisation structure and procedures of the municipality as a whole.

Within other departments of the municipality, it is found that the municipality says it is benevolent for circularity. Yet, not a lot of the procedures are organised standard for circular construction. The barriers that appeared in the cases have to be taken seriously for successfully establishing a circular UAD. Further research is necessary for dismantling some of the barriers.

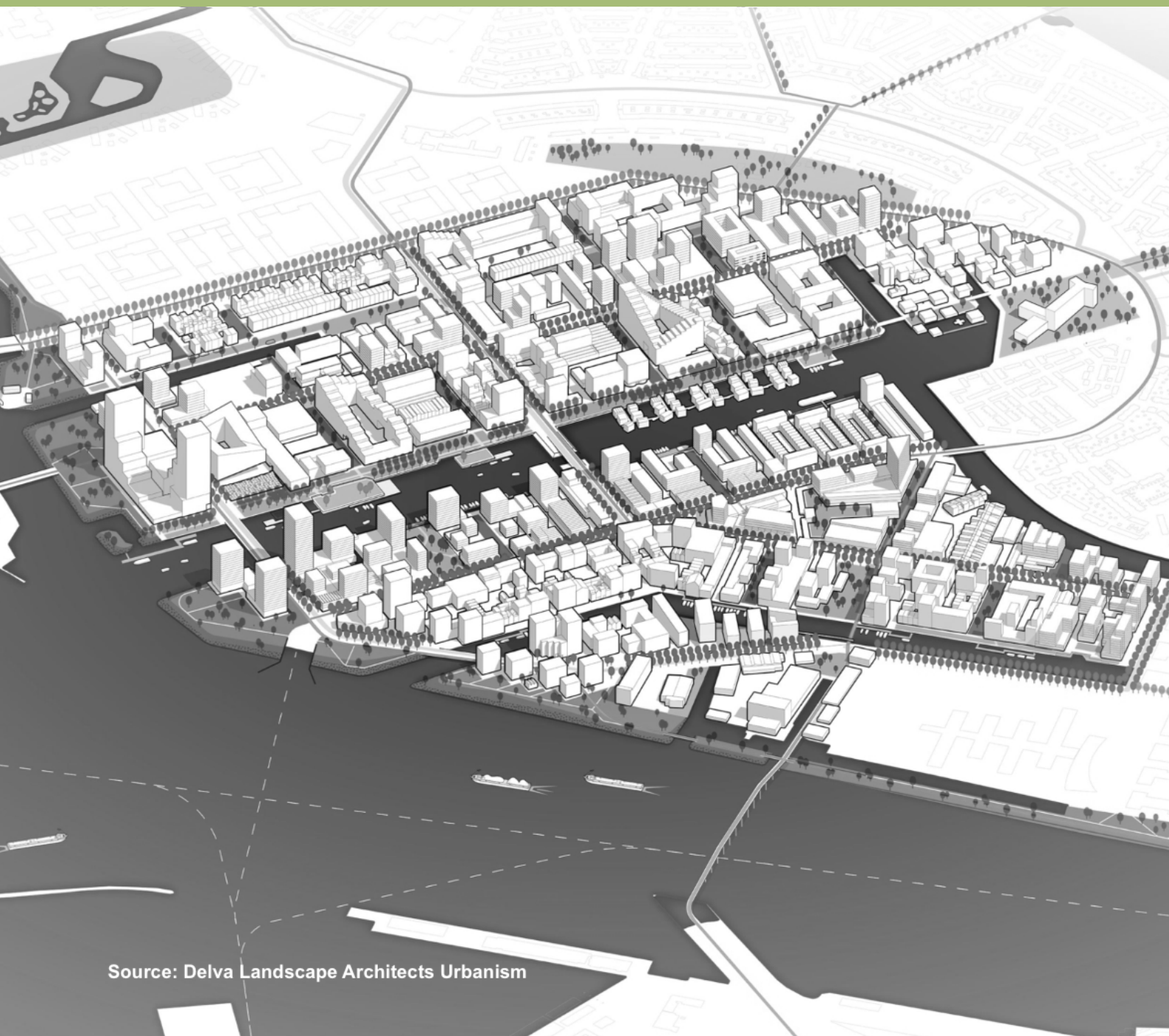
Lastly, there are plans by the municipality to build a riparian park and multiple green parks and places. Though the interviewees complain about the lack of initiatives and circular projects up and running. Inhabitants that did not realise/develop their own house but moved into a circular building are a lot less directly involved. They wish for updates and better imaging of the area. When driving through Buiksloterham in June 2020, you see a lot of concrete, hardware stores and little green areas. This gap between the plan and ideas of the municipality and what the inhabitant can be filled by better imaging and participation of the municipality.

Part IV - Research review

Chapter 7 - Discussion

Chapter 8 - Conclusion

Chapter 9 - Recommendations



Source: Delva Landscape Architects Urbanism

7. Discussion

This chapter discusses the case study findings with the theoretical background (7.1), with the current situation in Buiksloterham (7.2.1), Amsterdam (7.2.2) and with the consequences of COVID-19 (7.2.3). These paragraphs together answer the questions: *What do the cases of Buiksloterham provide as learnings for circular urban area development in literature and for the city of Amsterdam?*

7.1 Theory framework of circular strategies

The literature study discussed urban area development, sustainable development and circular economy, to provide an overarching framework to indicate, structure and reflect upon circularity in urban area development. The framework presents nineteen strategies. These strategies are found in similarities between sustainability and the circular economy by the research of Geissdoerfer et al. (2017), in a study in the three core concepts of CE by Kirchherr et al. (2017), and other prominent researchers of both theories. In the case studies, the framework is used to find the practical aims of the strategies.

A core principle of the Circular Economy is 'system perspective', which occurs in the economy, design, scales and stakeholders' aspects. It is found that practical aims in these aspects are limited compared to the other aspects. 'Operate circular principles at all scales' could not be translated into one practical aim in any of the cases. At the same time, according to the theory study, this is the strategy most directly responsible for the system perspective. This can be partly explained by the search for circular strategies in single projects, and not in the area as a whole. However, it remains that interviewees were less familiar with these strategies compared to the ones fitting the other two core principles. The R-framework and Waste hierarchy have the upper hand in the aspects of energy, materials, water and nature and are more recognised in practical aims in the cases. This research shows that not all core principles are considered equally responsible for fulfilling projects with high circular ambitions in Buiksloterham.

Moreover, the literature suggests that there is no consensus about the relationship between SD and CE. SD is defined as an equal and balanced combination of three dimensions: environment, economy and society. CE is about a regenerative system that aims at closing cycles. The definition by Krichherr et al. (2017) has the most momentum. They describe CE as the operation of sustainable development, saying CE results in creating environmental quality, economic prosperity and social equity. This is in contrast to Geissdoerfer et al. (2017) saying CE prioritises the economic system and the additional benefits for the environment. Social aspects are implicit gains of the economic system, according to Geissdoerfer et al. (2017). The difficulties with the two concepts are visible in the cases. Within the start of the four projects, circularity was not a known concept. Still, these projects were the basis for the Circular Buiksloterham manifesto and the operation of a circular UAD by the municipality. The framework includes strategies based on the similarities between the two concepts. This explains why strategies in projects that did not consider the concept circularity in design and construction, still fit the framework. It is found that no distinction is made or mentioned between

the two concepts. Projects started as projects with high sustainable ambitions, are now labeled high circular ambitions, without any changes in their designs or planned strategies. Besides, the lack of social strategies shows there is no consensus about whether the social dimension is a favourable side effect of the circular economy or an equally important pillar.

Lastly, the list of strategies is suitable as a tool for recognising circularity in the built environment. Nevertheless, some strategies could not be placed in the framework by the interviewees. One was the use of bio-based materials or choosing new materials because they are easy to reuse in the future. The use of bio-based materials fits the cradle2cradle theory, as both materials can be returned to the forest as natural nutrients after the disassembly. Cradle2Cradle is clustered under the strategy 'closed material cycles' (Appendix I). Besides, this strategy is found in the butterfly diagram of the EMF (2015). This should be presented clearer in the framework. The second missing strategy was the lack of social strategies. An explanation for the less 'social' strategies can be given by the circular economy theory of Geissdoerfer et al. (2017). According to their research, quoted above as well, "the CE clearly prioritises the economic systems with primary benefits for the environment, and only implicit gains for social aspects" (Geissdoerfer et al. 2017, p. 764). In the framework, many strategies are from the study of Geissdoerfer et al. (2017). This could explain why the interviewee was missing the social dimension. Besides Geissdoerfer et al. (2017), more researchers reflect upon the lack of incorporating social dimension in CE. Smith (2014) states that the CE seldom considers people's behaviour, while some aspects of circularity are clearly a choice of consumers. The third comment is about involving locals in the development that is initially the responsibility of the municipality. It is reflected with the interviewee who named this, that it could have been placed under 'cooperation of different stakeholders'. It should be more explicit in the framework that this includes collaboration in projects top-down and bottom-up.

7.2 Circular UAD in Amsterdam

7.2.1 Buiksloterham

The four separate projects do not indicate a circular UAD. This has two causes. First, a large part of Urban Area Development is the infrastructure (GWW). This research excludes the GWW in Buiksloterham. This limitation stems from the current development in Buiksloterham. At the start of this research, only one GWW project was completed. In addition, only six of the real-estate projects came out suitable for research in projects with high circular ambitions. The circular strategies framework is therefore tested at single projects, instead of at the urban area development as a whole. Second, in addition to excluding the GWW, testing the single projects has led to a search in projects at the building scale. Circular UAD means integration of circularity at a larger scale.

The result of this research is a process study in the complete urban area development Buiksloterham, and an in-depth study in circular projects. The lessons learned can be beneficial for the municipality, as they focus on upscaling the circularity in projects on the UAD scale. The projects show the current opportunities, and the developers paved a way as pioneers with new experiments, plans and procedures. They showed opportunities to the municipality, and it is now up to the municipality to keep this up and facilitate more.

To conclude, this research does not give a complete answer for what the municipality should do to upscale circular UAD. Once projects in the public space are completed, research can point out various more possibilities for upscaling.

7.2.2 The city of Amsterdam and the Donut Economy

The municipality is making plans for a circular economy city-wide. At their request, they hired Kate Raworth to implement her Donut Economy strategy for the city of Amsterdam. This resulted in the publication of 'De Stadsdonut voor Amsterdam' in April 2020. The theory is that the economy of an area (in this case, Amsterdam) must remain within two limits: a minimum welfare level and a maximum of environmental impact (Raworth, 2017). The city doughnut describes three necessary actions for urban area development.

First, they state that from 2022, all new designs for UAD and public space will be based on circular criteria, including the use of sustainable materials and changing the utility. Concrete action points are the use of reused or bio-based materials, and the requirement of value inventory, which includes (raw) materials. Both action points are being discussed for Buiksloterham. Within the municipality, a workgroup 'Duurzame en Circulaire uitvoering' focuses on circularity in the public space. A first value inventory in the current area has been made. Second, from 2023, the use of circular criteria will be the standard in buildings and public space. This can be done via purchasing, tendering, and tenders for land allocation. The action points include the stimulation of innovation and circularity in the market and in internal processes in the municipality. For the stimulation of innovation, lessons learned from Buiksloterham are interesting for the municipality. Third, from 2025 onwards, fifty per cent of renovations and maintenance will be carried out according to circular principles, among other things in social and private housing, social real estate and schools. The action points are focused on facilitating knowledge and stimulation of innovations. They can gain knowledge of learning from developers in Buiksloterham.

The formulation of these three actions and the concrete points underneath, still seem a little general. Concrete resources and instruments for measuring and indicating have not been set. However, they are well on their way with the plans to implement these three measurements in Buiksloterham. This research can help to realise a more targeting approach for the municipality. It is recommended to learn from Buiksloterham. This area pioneers, and has developers leading the way for circular real estate projects.

7.2.3 Consequences of COVID-19 for UAD

During this research, a global pandemic of the coronavirus disease COVID-19 started. The following national lockdown in the Netherlands will affect the construction sector. There are a few scenarios possible for the construction sector, the municipality and with that the development in Buiksloterham.

Historically, an economic crisis has significant long-term consequences for the construction sector. This is partly due to the availability of money from the national government. The municipality will have less money available for the construction sector, as it has to absorb unforeseen consequences of the corona-crisis. In addition, clients will become more cautious. This will lead to postponement of non-urgent construction or maintenance, and delays in UAD. It is not expected that the demand for housing will decrease significantly. The municipality will have to continue to make resources available, and there will still be a market for clients. An economic crisis leads to a recession and the loss of many jobs. But as the expressions says: never waste a good crisis. It can be an opportunity to establish a new economic model. The

doughnut model of Kate Raworth and the CE system aim to generate numerous new jobs. A faster implementation of CE means more circular UAD.

Implementing circularity in times of crisis is in Buiksloterham an interesting case. The construction started in the middle of an economic crisis in 2009. Because the demand for development in BSH was deficient, the municipality started bidding on sustainability criteria. This was the start of Buiksloterham becoming a ‘circular’ urban area development. It is unlikely that the same scenario will happen again since there still is a high demand for housing. However, there might be more room for initiatives from the market. Large investors have less to spend, and the land price can decrease. A lower land price might attract smaller investors who are more focused on circular development than high profits of selling apartments. Besides, people might prefer to live further apart instead of several apartments in one building, where people use the same elevator, doorknobs, sewerage, air-conditioning etcetera.

We do not know how the new COVID-society will look. The current policy includes a 1,5-meter distance society and a ban on gatherings of large groups. Use of public transport has dropped dramatically. The risk for a new pandemic will become part of our society. So, the public space will logically be designed for a 1,5-meter society. There will be less use of public transport, so the public space must be designed for bicycles and cars. The use of cars is not desirable in circular area development, so there is room for innovations. Also, changes are desired in the current sewage and ac-systems, as research points out that viruses can spread via these. It will give a new dimension for the current pilot with ‘Nieuwe Sanitatie’ in Buiksloterham, the system in which the toilet water (blackwater) is separated from the greywater. There will be demand for a safer sewage system.

8. Conclusion

This chapter answers the research question: How can the Municipality of Amsterdam scale up circular urban area development by learning from projects with high circular ambitions in Buiksloterham? The four sub-questions that led to the main research question are answered in the reflections of the theory study (2.3), the methodology in chapter three and chapter 6.

It appears that two issues are essential for upscaling circular urban area development by a municipality. The first issue concerns the role during the realisation of the projects, and the second is about the implementation of circular strategies. Both issues are interlinked, and a right combination of both will lead to possibilities for upscaling circularity in UAD.

The first issue concerns a policy and management issue. It is about how the municipality should operate to realise circular urban area development, during the single projects and within developing circular BSH. During the development of the four cases, most interviewees experienced collaboration from the municipality. Now, within the realisation of the area, the developers do not feel included. Buiksloterham involves many professionals in circular development. They have a natural motivation for a circular neighbourhood, which they have proven in the realisation of high circular ambitions. Besides, they have around ten years of experience with procedures, plans and the methods of the municipality. Their lessons learned can be of great value for new developments. Their knowledge and capacity can be used to link and create suitable collaboration and exchange patterns between new developers and the municipality. Engaging them will have a positive effect on creating a circular UAD.

The municipality should keep initiating, facilitating and controlling in and with new projects. If circular development is the top priority in BSH, the municipality must make sure the inhabitants and participants feel and see this as well. Now, there are a few information gaps between the developers and the municipality. First, the developers ask for more controlling, while the municipality says they control adequately. Second, the ambitions of the department of land affairs are according to the developers conflicting with the ambitions of the city. Buiksloterham has mainly large projects like Patch22 in the planning. The municipality should make sure the same problems with the developer versus the department of land affairs will not appear again. A clear explanation of the different roles and ambitions of the various departments could help. Third, there is a cynical view about the aims of the municipality in the current development of Circular Buiksloterham, whereas the municipality is openly proud of their current actions. This can be (partly) resolved by a better image of the plans. If the municipality has plans for circular development and is eager for innovations, this has to come across in the area. Municipal projects should be easily accessible for inhabitants.

The second issue contains the development of circular strategies in the built environment. The circular strategies that work should be upscaled. The municipality should facilitate possibilities to implement on a larger scale, to realise a system perspective in the area. Strategies that appear to be suitable for evaluation and upscaling in this research are: Jouliette, Smart grid, ‘Nieuwe sanitatie with vacuum toilets’, wood as primary construction material, MAAS-project,

cleaning of polluted soil by plants, building on water, flexible designs, use of multi and interdisciplinary research fields. Not only does the municipality have experience with the application and procedures, which will save time. It also generates time-saving possibilities for developers. for assessing the strategies in tenders and or with subsidy schemes, there should be an integrated approach as much as possible. The 'menu' scorecard for grants should have room for deviations.

Both issues interlink, as the municipality should take an active role in facilitating exchange patterns and collaboration between current and new developers. In both issues, barriers are found. The barriers, based on the experiences of the developers, are discussed with the municipal officials, who represent the other viewpoint. This has resulted in the following points of actions for the municipality to dismantle the barriers. Executing these action points will lead to upscaling circularity in UAD.

Table 18: Bariers in circular strategies

Barrier	Action for the municipality
1. Apartment rights	The department of land affairs is responsible for the leasehold arrangement that include the apartment rights. They must analyse the leasehold arrangement for flexible apartment rights and flexible work/living structures. If there appears to be a problem with the current leasehold, changes must be made.
2. Land value calculation	A customised calculation must be done if developers prove that the only option for implementing their circular strategy leads to higher foundation costs. Analyse comparable projects as Patch22 and TopUp in Buiksloterham and other areas. Take the loss of face that Patch22 creates for the municipality serious.
3. Local drink water permits	The quality and grants for drinking water are the responsibility of the National Government (NG). The municipality can use their influence when they have enough resources to prioritise this barrier.
4. Integral approach for measurement of circularity	Aim for more customised measurement. Keep evolving the 'menu scorecard' system by reflecting on completed projects. Prioritise an integrated approach.
5. Building decree	The Building Decree is the responsibility of the NG, but the municipality has input opportunities about this topic. Specific barriers regarding the Building Decree can be presented in those input moments.
6. Legal jurisdiction implementing circularity	Stimulate the attraction of circular pioneers in the area where possible. Specific legal jurisdictions can be added as performance indicators in tenders and/or subsidy granting. Work towards a more binding version of the manifesto
7. Land price increasing	Research must be conducted in the possibility to keep the land price low for circular projects. The risks of taking on a redevelopment project without a tender agreement must be made clearer for developers.

8. Lack of knowledge by contractors	Inform and facilitate where possible. If new circular building methods become standard, the market has to move and learn to keep up. Leave room for bottom-up initiatives.
9. Contact with the municipality	Make it clearer for developers were to address issues regarding circularity. Inform developers about the different departments of the municipality. Fill this information gap.
10. Sinking of the excrement boat	Briefly analyse the incident. Make responsibilities of ownership and maintenance clear.
11. Waste separation	A recalibration of the central waste collection in the city of Amsterdam is needed. As Buiksloterham is a pioneer, the project team can put pressure on the city. In line with the ambitions of the municipality, the waste separation problem must become a priority city-wide.

To conclude, upscaling circularity in UAD requires a combination of good policy and management from the municipality. Key elements are: provide clear image and information of the plans. Explain the different roles of the municipality. Learn from the implemented circular strategies and aim for implementing the strategies on a larger scale. Upscaling requires attention for the barriers above. Involve the developers in both the development of the public space as with the new developers, because they have intrinsic motivation, professional knowledge and a lot of experience.

9. Recommendations

This chapter provides recommendations based on the gathered information in the interviewees and studying the cases. The recommendations are in line with the answer to the main question but are more practically focussed for the municipality. Paragraph 9.2 provides recommendations for further research.

9.1 Recommendations for the municipality

1. Initially, the municipality was wishing for a study in circular infrastructure projects (GWW). After a brief study in Buiksloterham, it was found that there were various roads in the planning phase, but only one GWW project (the Theo Fransmanbrug) was finished yet. At the time of realisation of that project (2013), no additional sustainability criteria were implemented. A process study in the GWW was therefore not possible. Still, after the study in real estate, some recommendations for the GWW can be made.

- Go for an integrated approach. Try not to see all roads, bridges and waterways separately, but go for a circular GWW on the UAD scale. Don't check circular boxes but try to measure the complete footprint.
- Involve the locals. Residents benefit greatly from a circular and green street in front of the door, and in Buiksloterham they appear to be willing to cooperate. According to the residents in the Bosrankstraat it was a great success in their street.
- Evaluate and monitor. The inhabitants of the Bosrankstraat had the change to design the GWW in their street. This project should have been evaluated during and right after the construction. Lessons learned can be applied to other streets. It can give a boost for the sometimes tricky relationship between the developers and inhabitants if they can think with and cooperate.
- The theoretical framework is also suitable for GWW. Use the framework to indicate, structure and reflect upon circularity in the GWW.

2. Collaborate with citizens in Buiksloterham. In realising a circular UAD, collaboration with residents is insurmountable. The advice for the municipality is to use two well-known strategies for collaboration and participation: the quadruple helix of Caryannis and Campbell (2009) and the participation ladder. The first is about a balanced collaboration between business, research & education, public administration and civil society (a follow-up of the triple helix). The latter one can be used to assess the degree of influence active citizens can exercise in Buiksloterham. According to Arnstein (1969, *p.* 216–224.), the ladder can help to elevate and clarify the social debate about participation.

   A few short-term practical recommendations for participation based on the authors' experiences in Buiksloterham are:

- Facilitate a neighbourhood committee. Residents, private commissioners and companies have almost ten years of experience with the investment decree and the zoning plan, and all permitted deviations. There are many experts in the field of green and sustainability, especially in SchoonSchip. Besides, they appeared to have an intrinsic motivation for circularity in the neighbourhood.

- When organising a participation moment, for example in the recalibration of the Investment Decision, make them feel equivalenced and give them some control.
- The lessons learned from implementing circularity concerning the law and regulations are of great value for new developers. These lessons learned concerns the personal learning experience. Facilitate interaction between old and new developers in the area.
- Realise better imaging of the current plans. For example, a billboard saying 'you are entering a circular neighbourhood in development' or present the plans in, for example, bus shelters.

3. Monitor, evaluate and assess the current strategies and if proven successful, upscale. It is favourable for the municipality to develop the current strategies further and on a larger scale. They can facilitate their experiences and work together with current developers. Also evaluate the problems around Patch22. They experienced a lot of issues with the municipality in their follow-up project TopUp, that they did not experience within Patch22.

4. Work towards a more binding version of the manifest. Publish the minimum requirements for the land issue that the municipality uses and other performance indicators that are required in buildings in Buiksloterham. This is part of a better communication of the plans and strategy of the municipality.

9.2 Recommendations further research

- The strategy framework is now tested on four real estate projects. The framework should be tested on a larger scale to see if the framework is a suitable indicator for circular urban area development. This includes testing the framework in public space projects. It can be a useful starting point for further research in circular urban area development.

  Regardless of the framework is in this research UAD only represented by the real estate projects. As discussed upon in 7.2, UAD also includes the infrastructure and takes place at a larger scale. After the development of projects in the public space in Buiksloterham, additional research into barriers are necessary. Besides, other UAD projects must be analysed and compared with the results of Buiksloterham to give a general opinion for the city of Amsterdam.

- Only one of the subcases is about the development of a loft with a private developer. This appears to be the case that had the most problems with the municipality. More research in the private development of high-rise projects is necessary to make an elaborate conclusion on the barriers. At the moment the municipality said they have spoken to other project developers that have the same ambitions but not that many problems. Nevertheless, these projects are not completed. Therefore, after the completion of more projects like Patch22, additional research in the barriers should be done.

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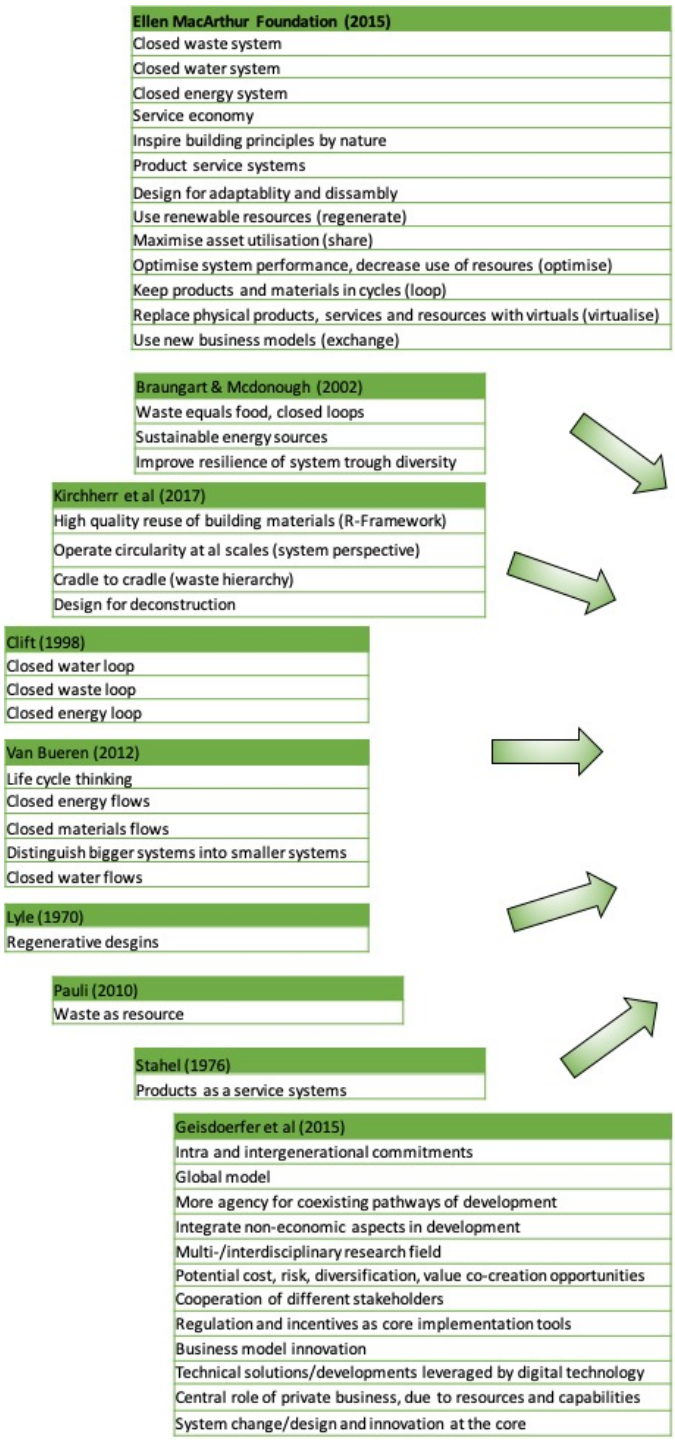
Appendix I - Clustering of the circular strategies

The following figure images all the strategies that are derived from the theories. When two or more researchers had the same strategy, it is clustered into one.



NR.	Aspect	Strategy	Source
1.	Energy	Closed energy system	(EMF, 2015; van Bueren, 2012; Clift, 1998)
2.	Energy	Use of sustainable energy resources	(Braungart and Mcdonough, 2002; EMF, 2015)
3.	Materials	Closed material system, waste as a resource	(EMF, 2015; van Bueren, 2012; Pauli, 2010; Sassi, 2008; Braungart&Mcdonough, 2002)
4.	Materials	High quality reuse of materials	(Kircherr et al, 2017; Sihvonen and Ritola, 2015; van Buren et al., 2016; Potting et al., 2017; Cramer, 2017)
5.	Water	Closed water system	(EMF, 2015; van Bueren, 2012; Clift 1998)
6.	Economy	Service economy	(EMF, 2015; Geisdoerfer et al, 2015; Stahel 1976)
7.	Economy	Businessmodel innovation	(EMF, 2015; Geisdoerfer et al., 2015)
8.	Economy	Potential cost, risk, diversification, value co-creation opportunities	(Geisdoerfer et al., 2015)
9.	Nature	Non-economic building principles inspired by nature	(Braungart and Mcdonough, 2002; EMF, 2015)
10.	Technology	Use of digital technology for virualisation	(EMF, 2015; Geisdoerfer et al., 2015)
11.	Design	Design for dissambly and flexibility	(EMF, 2015; Kirchherr et al., 2017)
12.	Design	Coexisting pathways of development	(Geisdoerfer et al., 2015)
13.	Scales	Operate circular principles at al scales	(Geisdoerfer et al., 2017; Van Bueren, 2018; Pomponi and Moncaster, 2018)
14.	Stakeholders	Intra and intergenerational commitments	(Geisdoerfer et al., 2015)
15.	Stakeholders	Cooperation of different stakeholders	(Geisdoerfer et al., 2015)
16.	Regulation and incentives	Regulation and incentives as core implementation tools	(Geisdoerfer et al., 2015)
17	Market level	Central role is in private business	(Geisdoerfer et al., 2015)
18.	Research	Make use of a multi- and interdisciplinary research field	(Geisdoerfer et al., 2015)

Appendix II - List of events

This list of events includes all the realised projects in Buiksloterham and the projects with official established construction plans. The project starts at the tender award or issuing, or when the tender could not be found at the moment the Municipality grands the first permit.

1. List of project events

Table 19: List of events on project level

Event #	Event	Dates	Observation circularity
1	**SO de Heldring** Primary school in BSH. First realised project where is decided on in Investment Decision 2009	**Start: 2012** **Completion: 2014**	- Climate neutral building
2	**Theo Fransmanbrug** A bridge for bicycles that connects the neighbourhood NDSM with the Papaverweg in BSH	**Completion: 2013**	- No specific circular strategies were involved according to designer Cyrus Clarck.
3	**De Ceuvel** This design won the competition from the municipality in 2011. It includes an office parc with ten units and a café.	Start: 2011 **Completion: 2014**	- Experiment of Jouliette in cooperation with Alliander - Aim to leave the soil cleaner than how they got it (plants) - Modular office buildings without foundation - Aquaponics system - Polluted soil is cleaned up by plants - Solution for the fallow polluted soil is found in the market - Less costs for water (dry toilets, own water purificatio - Long term investments in energy system - Pilot for using a solar energy as a currency (Jouliette) - Leasing ground from municipality - Sharing office space - Local retreatment of grey water into drinking water - Toilets without water (no wastewater) - Greywater system - Office parc, scaffolding and cafe are almost fully built with recycled materials. - Dry compost toilets - Use of struvite reactor - PV-Panels - Jouliette
4	**Collectiecentrum EYE** Storage of EYE museum	Start bouw: 2014 **Completion: 2016**	- Energyneutral building by using 800 PV-panes, high insulation, smart (re)use of energy

5	**Docklands** L-shaped sustainable complex with 44 apartments and 13 work-units. Winning project of the first tender in 2009	Tender: 2009 **Completion: 2016**	- PV panels for energy - Rooftop garden for heat protection - Self-sufficient heat pumps
6	**Patch22** High-rise wooden building for combined work and living. Winning project of the first tender in 2009	Tender: 2009 **Completion: 2016**	- Energy neutral building - CO2 neutral Pelletketels - PV-panels - Wood as main construction material - Rainwater collection - Greywater system - Plans for elevator as a service - Long term investments in energy system - Layout of living area is flexible regarding pipes and shafts, with hollow floors and ceilings. - Layout meets demands for work and living - Regenerative design based on the thought that we don't know the design wishes of the future - Legally binding sustainable commitments in tender criteria
7	**Lot 21: PUUUR, Black Jack, Nova Zembla, De Hoofden, Noord4US, Elta** Six plots with collective private commissioning buildings on initiative of residents. First tendered in 2009 but after bankruptcy of the project developer new issued in the market as six separate CPO projects in 2012.	Issued: 2012 **Competion: 2017**	- Tendered on sustainability criteria.
8	**Bosrankstraat (Lot 5)** First private commissioning (zelfbouw) project in Buiksloterham. Eighteen houses at 18 lots individually designed and constructed by the new ground owners.	Issued: 2012 **Completion: 2018**	- Greenhouse house - Energy from sun with greenhouse building - Houses not connected to district heating - Pv-panels - Reuse of wood as construction material - Rainwater collection - Greywater system - Greenhouse house (KasWoning) as new housing concept - Long term investments in energy system - Private commissioning projects - Design of the Greenhouse-residence in Archicad 3D - Adjustable floors - No load-bearing facades and removable main load-bearing structure - Menu scorecard for subsidy - Used multi-and interdisciplinary research fields

9	**Lot 3 (Monnikskapstraat)** Second urban block tendered for individual self-development. Successor of the projects in the Bosrankstraat	Issued: 2015 **Completion 2019**	- High quality reuse of materials when possible - Wooden construction, insulation and facades - PV panels as sustainable energy sources - Innovative use of ecological inspired tools
10	**Yotel** Hotel	Start: 2015 **Completion: 2019**	- Closed water loops - All-electric building with PV panels. - Energy efficient building process by off-site building, less transport = less CO2 - Reused building materials. - BREEAM New Construction Excellent rating
11	**De Groen oever** A quay that is needed as protection for the residences from ships in the IJ. Eventually it will serve as meeting place and public parc.	Start: 2011 Completion – not finished	- Heat protection by green development - Use of the silt in the canal to realise ecological quays
12	**Lots 20A - F** Developed by six different project developers. The second CPO project. A total of 44 houses, 56 work-living houses, 16 workspaces and 142 parking lots.	Issued: 2015 Start construction: 2018 Completion: not finished	- Green roofs - PV-panels for sustainable energy - Reused materials - Lot of wood in construction - Modular concrete construction - Adaptive building for work/living mixture/variety
13	**Papaverplantsoen** First part of the realisation of a green playground and meeting place	Partial completion: 2017	- Creating a community - Replanting trees
14	**TopUp** Successor of Patch22	Start: 2016 **Completion: 2020**	- Wooden load-bearing construction. - Build for flexibility, space fulfils the requirements to transform the area in work/living/hotel etc. - Reuse of existing concrete construction and reusable materials.
15	**Schoon Schip** Floating village in Johan van Hassalt canal.	Tender: 2013 **Completion: 2020**	- Local and interchangeable energy generation with only one general connection to the energy grid - Efficient use of energy, reduction - Insulation - PV-panels - Heating with water pumps in canal - Each home has storage battery - 'Nieuwe Sanitatie' project with vacuumtoilets for upcycling excrement - Reuse of wood as construction material - 'Nieuwe Sanitatie' project - Rainwater collection - Vacuum toilets

			- Mobility hub for electric bikes and cares - New layers of ownership - Long term investments in energy system - Crowdfunding - CPO project - Biobased products/materials - CO2 meters that automatically ventilates - Technology that shows and keeps track of the energy generation and consumption per lot - Build on water - Creation of a community - Experiment of toilet system with Nieuwe Sanitatie of Waternet - Experiment of energygrid together with Westpoort Warmte - Other subsidies - Menu scorecard for subsidy - Used multi-and interdisciplinary research fields
16	**Vrije Kade 1** A building block at the Johan van Hasselt canal with 32 residences, 15 apartments. Two other building blocks are planned for construction.	Start: 2016 - In Construction	-
17	**Lot 2** New street of private commissioning projects (zelfbouw)	Start: 2016 - In construction	-
18	**Republica** Six blocks, three for housing, one apartment tower, one hotel, and two business units.	Start 2018 - In construction	- Use of Smartgrid - PV panels - Green facades
19	**Cityplots (Buiksloterham&CO) (lot 47-48-49)** Development of a city district at three lots in BSH. Combination of apartments, social housing, residences.	Start: 2018 - In construction	- Planned to experiment with water/toilet pilot from SchoonSchip (canceled anno 2020)
20	**Kop Grasweg** Three lots directly at the IJ shore, mixed neighbourhood for living and working purposes. Realisation of 350 apartments and 3800square meters of commercial spaces.	Expected start: 2021	-
21	Hotel Grasweg 46	Start 2016 - In construction	-

22	New Road between Klaprozenweg and Grasweg	Expected start 2021	-	Plans for sustainable and energy neutral infrastructure

Abbreviations: BREEAM-NL = certified sustainability criteria; BSH = Buiksloterham; EU = European Union; PVE = Programm of demands (dutch: programma van Eisen);

Figure 18 shows a timeline of all the projects in BSH, with the issue date as a start, and the completion date as finish.

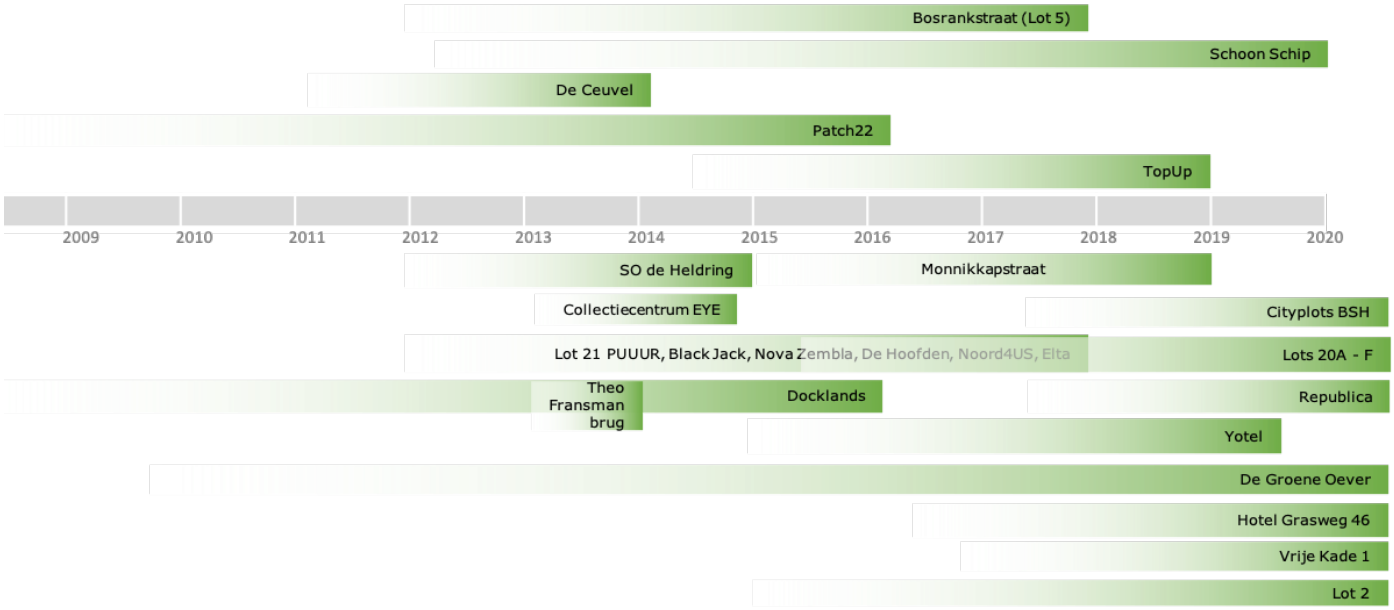


Figure 18: Timeline development of projects in Buiksloterham (tender - completion)

2. List of process events

Table 20: Lists of events process level (documents)

Event #	Policy layer	Event	Date	Observation
D1	A	Masterplan North-bank of the IJ	2003	The traditionally industrial area BSH becomes a possibility for a new work-living area
D2	A	Projectbesluit Buiksloterham	2005	Official decision for the urban area development in BSH
D3	A	MER-Procedure BSH	2006	The strategic environmental assessment of the Buiksloterham area
D4	A	Investeringsbesluit en grondexploitatiebesluit	2006	Investment decision and decision on the exploitation of the ground
D5	EU	Waste directive 2008/98/EC	2008	European directive that sets the basic concepts and definitions related to waste management. Its goal is to lay the basis to turn the EU into a recycling society.
D6	A	Klimaattafel Buiksloterham	2008	Initiative of the municipality of Amsterdam, part of the climate program of Amsterdam. Advise for CO2 reduction in urban area development
D7	EU	Renewable energy directive 2009/28/EC	2009	A directive for promotion for the use of energy from renewable reserouces.
D8	A	Bestemmingsplan Buiksloterham	2009	Legally binding Land-Use plan for the area Buiksloterham.
D9	A	Exploitatieplan Buiksloterham	2009	Final exploitation decision for BSH.
D10	A	First Duurzaamheidstender Buiksloterham	2009	Tender were the projects Docklands and Patch22 won. First projects after the land use plan in BSH.
D11	A	Decision for irrevocable Exploitation decision	2011	After declaring the Exploitationplan irrevocable it must be revised yearly.
D12	A	Structuurvisie Amsterdam 2040	2011	New ambitions by the municipality of Amsterdam. Buiksloterham openly came forward as interesting location for housing. BSH is supposed to be in transformation until 2030.
D13	BSH	Haalbaarheidsonderzoek Schoon Schip and De Ceuvel by Space&Matter, Waterloft.nl and Metabolic	2011	A feasibility study in BSH by participating parties in the development of De Ceuvel and SchoonSchip. The study was focused on new innovations regarding sustainability.
D14	EU	Manifest for resource efficient Europe	2012	Policy document by the European Union about the better use of fossil fuels, natural resources and materials. Key event for Dutch government.
D15	BSH	Winning strategy competition De Ceuvel	2012	10 year groundlease assigned to the Ceuvel by the municipality
D16	A	1e, 2e en 3e partiele herziening bestemmingsplan	2013	The first facilitated private commissioning projects. This resulted in the project Bosrankstraat. The second was regarding the expansion of public space

				boundaries. The third again about self-commissioning now for two other streets.
D17	EU	Circular Economy Action Plan	2015	First policy document by the EU acknowledging the circular economy as solution for climate problems.
D18	NL	Netherlands circular in 2050	2015	The establishment of a government wide programme for a Circular Dutch Economy by 2050 and a reduction of 50% of raw materials consumption in 2030.
D19	A	Amsterdam Circular: Road map & vision	2015	A study executed by the city of Amsterdam to identify areas in which Amsterdam can make the most significant, tangible progress in realising circular economy. The document reports details of the system processes in Amsterdam.
D20	BSH	Manifest Circulair Buiksloterham	2015	Initiative by inhabitants of Buiksloterham. Over 25 parties sign a circular manifest. The municipality translated the manifest into a concrete program.
D21	A	Agenda Duurzaamheid	2015	Buiksloterham is named as pioneer and leader for the Amsterdam urban area developments in the field of sustainable and circular development.
D22	BSH	Circular Buiksloterham	2015	Feasibility study and long-term action plan in the chances for Buiksloterham to become a leader in circularity. The study was commissioned and executed by a consortium of local stakeholders.
D23	A	Koers 2025	2016	Buiksloterham is pointed out as mixed use neighbourhood and as area that can quickly help reduce the housing problems. The pressure on the available space is increasing.
D24	A	4e herziening bestemmingsplan	2017	A fourth revision of the land use plan in Buiksloterham. The revision regards the boundaries on the north side.
D25	NL	Green Deal duurzaam GWW 2.0	2017	All signing parties agree on long-term collaboration to reach the climate objectives of the Netherlands.
D26	NL	Nationaal Grondstoffenakkoord	2017	Raw Materials Agreement. An agreement what 180 parties in the (materials) industry and the government signed. It is focused on what needs to be done to ensure that the Dutch economy can run on renewables resources. It is a follow up of the European directive **D7**, it is not legally binding.
D27	BSH	Buurtvisie 2018	2018	Inhabitants, self-constructors and businesses wrote a vision for the future of BSH together. The core of this document is about the willingness to participate from the writers. They suggest it is meaningful and for the greater benefits to complement to the revision of the HIB together. According to one of the writers

				John Zondag the municipality did not respond on the suggestions.
D28	BSH	Partial revisions Exploitation decision BSH	2012-2019	The partial revisions in the land use plan also led to revisions in the Exploitation decisions. In addition, a revision is made to make SchoonSchip possible. Other revisions were mainly based on the division work/living (more living) and approving to build higher.
D29	BSH	Plan duurzame bouwlogistiek en BLVC	2019	Plan written by the municipality to show developers possibilities for circular and sustainable construction.
D30	BSH	**Herijking Investeringsbesluit Buiksloterham**	2019	The latest version in 2019 includes plans for 8575 dwellings with 36% workspace. The total amount of green is below the minimum the municipality demands in public areas (interviewee 2). This event led to dander by inhabitants in the area.
D31	EU	A New Circular Economy Action Plan	2020	The new circular economy action plan presents measures for sustainable products, empowerment of consumers and public buyers and potential for circularity in: - Construction and buildings - Electronics and ICT - Batteries and vehicles - Packaging - Plastic - Textiles - Food - Water and nutrients - Ensure less waste It presents measures to make circularity work for people regions and cities. (NCEAP, 2020)

Abbreviations: EU = European Union; NL = Dutch Government; A = Municipality of Amsterdam; BSH = Buiksloterham; P = Subproject within BSH.

Appendix III - Interview protocol

“Analysing circular strategies in Buiksloterham”

INTERVIEW NR:	**#**	
DATUM:		
INTERVIEWER:	Heleen Joustra	H.joustra@amsterdam.nl
GEINTERVIEWDE:		

1. INTRODUCTIE

DOEL VAN HET INTERVIEW

Het doel van dit interview is om inzicht te krijgen in de implementatie van circulariteit in gebiedsontwikkeling in Buiksloterham. Hierbij gaat het zowel om het proces, als om de uitkomsten in de gebouwde omgeving. In mijn afstudeeronderzoek ben ik op zoek naar strategieën uit Buiksloterham die de Gemeente kan standaardiseren om andere gebiedsontwikkelingen circulair te maken. Hiervoor kan dit interview een grote bijdrage leveren. Ik ben voornamelijk geïnteresseerd in het proces en de rol van de Gemeente hier in, de circulaire strategieën die zijn toegepast en de meerwaarde die circulair bouwen heeft opgeleverd.

OVER MIJ

- Heleen Joustra, Master student Construction, Management and Engineering aan de TUDelft, civiele techniek. Bachelor Technische Bestuurskunde
- Afstudeeronderzoek in samenwerking met de Gemeente Amsterdam en project Buiksloterham.
- Geïnteresseerd in duurzame constructie, circulariteit en gebiedsontwikkeling.

TIJDSDUUR

Circa 1 uur.

PRIVACY

Volgens de nieuwe data en privacy wet- en regelgeving van de TUdelft moeten wij iedereen geïnterviewd wordt om een handtekening op dit document vragen.

Handtekening:

Hoe wilt u geciteerd worden?

Mag ik een opname maken van ons gesprek?

- Ja
- Nee

Voordat ik begin zou ik nog graag willen meegeven dat er geen goede of foute antwoorden zijn op de vragen, het draait volledig om uw eigen ervaring. Heeft u problemen met een van de vragen of geeft u liever geen antwoord dan is dat geen probleem.

***Alvast ontzettend bedankt voor uw tijd**

2. INTERVIEW VRAGEN

ALGEMENE VRAGEN

1. Kunt u kort wat vertellen over het/uw project? Wanneer en hoe is het van start gegaan?
2. Wat is uw functie/rol in de ontwikkeling van Buiksloterham en dit project?
3. Vanaf welke fase bent u in dit project betrokken geraakt?
4. Wat was uw motivatie om mee te doen aan dit project in Buiksloterham?
5. In welke fase is het project nu?

CIRCULAIRE STRATEGIEEN

6. Wat verstaat u onder circulaire economie?
7. Wat verstaat u onder ‘circulair’ Buiksloterham?
8. Wat waren uw circulaire ambities? Wat heeft u gedaan / hoe heeft u hieraan meegewerkt?
9. Als u de bijgevoegde lijst van circulaire strategieën uit de literatuur bekijkt, welke herkent u dan in uw project?
10. Welke circulaire strategieën heeft u toegepast (die hier niet in de lijst staan)? Kunt u concreet voorbeelden noemen?

ROL VAN DE GEMEENTE

11. Waarvoor had u de Gemeente nodig in uw project? Wat was de rol van de Gemeente?
12. Hoe vond u het proces gaan? Liep/loopt het project ongeveer volgens de planning?
13. Hoe was uw ervaring met de Gemeente en hun visie op circulaire ontwikkelingen?
14. Zijn er besluiten aangepast gedurende de ontwikkeling van het gebied? Hoe ging het doorvoeren van deze veranderingen?
15. Waar liep u tegen aan bij de Gemeente bij het implementeren van de circulaire strategieën? (barrières)
16. Wat ging er allemaal goed en welke prestaties bent u trots op? Kunt u een aantal voorbeelden noemen?
17. Heeft u adviezen voor de Gemeente om het implementeren van circulaire strategieën gemakkelijker/beter te maken?
18. Welke andere stakeholders waren belangrijk/ had u kennis van nodig in het proces?

AFSLUITING

19. Zijn er nog vragen/opmerkingen vanuit uw kant?
20. Heb ik dingen gemist waar u nog graag wat over zou vertellen?

Appendix IV – Outcomes interviewees

Table 21: Summary of relevant interviewee information (quotes and own interpretation of interviews)

Interviewee Interview questions	**1**	**2**	**3**	**6**	**7**	**4**	**5**
Inhabitant of BSH?	*Yes*	*Yes*	Yes	Yes	Yes	No	Yes
Actively Involved by realising manifesto 'Circular BSH' or other neighborhood participation projects with municipality?	*Yes*	*Yes*	*Yes*	*Yes*	*No*	*No*	*No*
Involved from the beginning of the project process?	*Yes*	De ceuvel yes, SchoonSchip no	*Yes*	*Yes*	*Yes*	*Yes*	*No*
Definition of circularity/ circular economy?	*Closing material, energy and all other flows in a efficient way. Within planetary boundries (Kate Raworth) and with a fair development. We follow the seven pillars of Metabolic*	*Circulair is dus van de geschiedenis weer terug naar de toekomst. Niet alleen kringlopen sluiten maar alles wat we ooit vervuild hebben weer terug draaien. Voor mij is circulariteit gewoon menselijk handelen op aarde. Als ik dan een iets makkelijker voorbeeld kan geven: net zo veel CO2 absorberen als dat je uitstoot. Wezenlijk op fysiek niveau, stukjes stof, ik denk niet als een econoom.*	*Circulariteit is nu het codewoord voor lokaal hergebruik. Zelf als persoon is circulariteit natuurlijk dat je de middelen gebruikt die je nodig hebt voor een gezonde en leefbare omgeving. Dat je de grondstoffen gebruikt die daar toereikend voor zijn om dat te kunnen realiseren. Maar ook dat de energie die nodig is om dat te creëren. Circulariteit gaat er om dat je goed nadenkt over wat je uit het systeem haalt en wat je er in terug brengt., het liefst is dat in balans. Dat kan op veel manieren, voeding, spullen die je gebruikt/hergebruikt, behoud van materialen.*	*Om te beginnen ik heb een bloedhekel aan het woord 'circulair'. Het belemmert zicht op de kern van de essentie. Essentie is namelijk dat niks vanzelf rondgaat. Regeneratief is een veel zuivere beschouwing. Het circulaire systeem is totale bullshit, draai het eens om. Een open-systeem komt er een krankzinnige hoeveelheid energie hier binnen.*	*Wij hebben een soort convenant gesloten waarin de gemeente zich committeert aan de circulaire doelstelling. Dat versta ik onder circulair BSH. Dus het circulaire gebruik, het natuurlijke gebruik van het materiaal daar heb ik uiteindelijk heel veel in geleerd. Hoe dat anders kan. De keuzes zijn toch ook, hoe zit de economie in elkaar. Wat kan je krijgen van je geld. Hoe kan je het zo construeren tot een positief resultaat.*	*Circulair bouwen is gebouwen ontwerpen die veel makkelijker een toekomstig leven kunnen accommoderen. Circulaire strategie gaat over het sluiten van kringlopen. Het gaat over het zo min mogelijk onttrekken van nieuwe materialen aan de aarde. Je hebt daar die beroemde schema's voor met een paar van die cirkels. Alleen vind ik het maf dat iets wat laag op de R ladder staat de grootste cirkel daar heeft.*	*Alles wat je koopt op gebruiken of hergebruiken voor een ander doel. Om te kijken hoe de cirkel rond gemaakt kan worden. Dat is hoe ik het zie. Ik ben verder geen kenner.*
Active participation with other Stakeholders?	*Yes*	*Yes*	*Yes*	*No*	*No*	*No*	*No*
Circular strategies framework	*Filled in without comments*	*Elaborate comments on every strategy*	*Elaborate comments on every strategy*	*Elaborate comments on every strategy*	*Elaborate comments on every strategy*	*Elaborate comments on every strategy*	*Elaborate comments on every strategy*

Table 22: Opinion on municipality involvement

Final opinion Municipality involvement	1	2	3	6	7	4	5
Role of the municipality in project?	*Positive*	*Positive*	*Positive*	*Neutral*	*Positive*	*Negative*	-
General opinion on role of municipality realising circularity in BSH?	*Neutral*	*Negative*	*Neutral*	*Negative*	*Neutral*	*Negative*	*Negative*

Appendix V - Interviews municipality of Amsterdam

Hoofdvraag onderzoek: *Hoe kan de gemeente Amsterdam circulaire gebiedsontwikkeling opschalen door te leren van projecten met circulaire ambities in Buiksloterham?*

ALGEMEEN

1. Wat is uw rol in (circulaire) gebiedsontwikkeling?
2. Hoe heb jij de ontwikkeling van “circulair” Buiksloterham meegemaakt?

ROLLEN GEMEENTE

3. De volgende rollen die de gemeente kan spelen in de ontwikkeling van een project in gebiedsontwikkeling zijn gevonden; herkent u deze rollen en heeft u nog toevoegingen hieraan?
4. Vanuit welke rollen denkt u dat circulariteit het beste doorgevoerd kan worden?

Private rol	Comments	**Toevoeging Buiksloterham:**
1. Grondeigenaar	Verkoper van de grond Bepaald de prijs van de grond	
2. Instruerende rol	De gemeente kan extra eisen opleggen voor de constructie op de door hun uitgegeven land.	

Publieke rol		
1. Controlerende rol	Schrijft bestemmingsplan, geeft vergunningen uit, controleert of de bouw zich houdt aan bouwbesluit.	
2. Faciliterende rol	Subsidies voor duurzame ontwikkeling Experiment vergunningen Artikel 19 procedure (uitzondering op land use plan)	
3. Initiërende rol	De gemeente kan een initiatief op de markt brengen (de Ceuvel)	
4. Uitvoerende rol	Alleen voor publieke ruimte	

BARRIERES CIRCULAIRE STRATEGIEEN

De geïnterviewde zijn gevraagd of ze barrières zijn tegenkomen tijdens hun project. Een aantal van deze barrières zijn vanuit hun beleving gelinkt aan de gemeente. Ik zal kort uitleggen waar deze barrières vandaan komen en wat ze inhouden.

5. Ik zou graag willen weten of jij:
    a. De barrière herkennen/ eerder van deze barrière gehoord?
    b. Of er van uit de gemeente wat aan te doen is, en zo ja wat?
    c. Of er van uit de ontwikkelaars kant wat aan te doen is?

1. Appartementsrechten

De projectontwikkelaar van Patch22 heeft architectonisch zijn appartementen 'flexibel gebouwd'. Dat wil zeggen geschikt voor wonen en werken en makkelijk uit te breiden of kleiner te maken als de vraag hier naar is in de toekomst. Volgens hem leg je op dit moment het aantal vierkante meters vast als een appartementsrecht waardoor dit niet mogelijk is.
"Als je dat op papier inflexibel maakt dan werkt dat door in je splitsingsakte en die splitsingsakte is weer de basis voor hypotheekverstrekkers. Dus op het moment dat je in de toekomst dingen zou willen wijzigen en je hebt dat niet van tevoren geregeld dan moet je vervolgens bij alle hypotheekverstrekkers toestemming vragen om het gebouw te mogen op splitsen in kleinere delen." Als je dit dus niet van te voren regelt komt er later niks meer van terecht.

Hierdoor werden zij belemmerd in het flexibel maken van hun appartementen.

2. Berekenen van grondprijs

Marktwaarde – stichtingskosten is de som voor grondprijs berekening. De stichtingskosten staan vast volgens het bouwbesluit maar duurzaam bouwen is vaak duurder dan wat in het bouwbesluit wordt gerekend. Daarnaast kreeg de projectontwikkelaar te horen dat hij zijn stijging in kosten moest doorrekenen in zijn marktwaarde (duurder verkopen). Maar daardoor werd zijn grondprijs nog een keer duurder.

Hij gaf aan dat hij te maken had met hoogste marktwaarde min een verlies in stichtingskosten. Dus in deze berekening er dubbel voor betaalde, naast dat hij al meer betaald voor het kopen van duurzaam materiaal. Hierdoor heeft hij minder circulariteit kunnen toepassen dan hij had gewild.

3. Stijging van grondprijs/meer project ontwikkelaars minder CPO&Zelfbouw

Doordat de grondprijs nu een stuk duurder aan het worden is, geloven huidige bewoners dat dit ten koste gaat van het investeren door projectontwikkelaars in duurzame strategieën.

De buurt wordt nu aangetrokken door, ik quote, "een bak met haaien", die hier nu willen gaan bouwen zodat ze veel geld kunnen verdienen. Als bewoner ben je intrinsiek gemotiveerd voor circulariteit ook in de wijk maar als projectontwikkelaar minder.

4. Contact met de gemeente

- Geen afdeling voor duurzaamheid
  Een geinterviewde gaf aan dat hij brieven had geschreven naar de wethouder duurzaamheid en de raad over zijn zorgen dat afdeling grondzaken duurzame initiatieven onmogelijk maakt. Hij kreeg toen een brief terug van de wethouder grondzaken.
- Projecten zoals SchoonSchip duren heel lang. De projectleider vanuit de gemeente wisselde onder andere daar door heel vaak. Er is aangegeven dat veel tijd verloren is gegaan doordat er steeds nieuwe kennisoverdrachten plaats moesten vinden.

5. Menukaart - Geen integrale methode om circulairteit te meten. Instalitie arm soms beter dan de duurzame instalatie

6. Lokaal drinkwater maken niet mogelijk

De Ceuvel wilde dit. Waterkwaliteit goedgekeurd door waternet. Maar hier is geen vergunning voor mogelijk.

7. Bouwbesluit

- Dikkere isolatie muren leiden tot minder BVO. Daardoor een grote stap om voor te kiezen.
- Strikte regels waar onderdelen geplaatst moeten worden maken het moeilijk om flexible te bouwen (meterkast)

8. Milieustraat

6.Komen jullie vanuit jullie positie ook nog andere barrieres tegen (algemeen en binnen de gemeente?)