VALUE CREATION WITHIN THE CIRCULAR PUBLIC SPACE

AN EXPLORATIVE STUDY OF VALUE INTERPRETATION AND TRADE-OFFS IN THE CIRCULAR PUBLIC SPACE

Oualid el Margai

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By

O. el Margai

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Preface

This work is the culmination of over seven months of research into value creation in the circular public space. It began as a suggestion from my first supervisor, Quirien, who shared a brochure on circularity in the public space. The topic immediately caught my attention.

My interest in this topic was shaped earlier through practical experience. Before starting this graduation project, I worked at the Municipality of Gouda within the department of Public Outdoor Space Projects. During this time, I was involved in several public space projects where circularity was not only an ambition, but a practical consideration in daily decision-making. Being part of a municipal team gave me insight into the complexity of spatial projects, where long-term thinking often needs to be balanced with short-term constraints. This experience strengthened my motivation to further explore how the public space can be developed not only more efficiently, but more meaningfully. Coming from a Civil Engineering background, I initially found it challenging to work with qualitative methods. It was a different way of researching than I was used to. However, the process taught me a lot and helped me grow, both personally and professionally.

I would like to thank my first supervisor, Quirien Reijtenbagh, for her help and support throughout this graduation process. Her thoughtful feedback helped me guide this research in the right direction. I am also grateful to my second supervisor, Erik-Jan Houwing, whose critical insights during the progress meetings challenged me to think more deeply. A special word of thanks goes to Joep van Leeuwen, my supervisor at the Municipality of Rotterdam, for sharing his expertise in this field and for supporting me in accessing perspectives from within the Municipality of Rotterdam. I would also like to acknowledge Sander van Nederveen, my graduation chair, for his role in overseeing the process. Finally, I would like to extend my gratitude to my parents for their continuous support, encouragement and love throughout this journey.

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Abstract

Municipalities are increasingly expected to integrate circular economy (CE) principles into the development of public space. However, the way in which value is conceptualised in this context remains underexplored. This study examines how value is interpreted and weighed in circular public space and introduces a framework to support more structured and transparent decision-making. A two-step research design was applied, combining a systematic literature review with a qualitative case study of the Municipality of Rotterdam based on ten semi-structured interviews. The abductive approach allowed theoretical insights and empirical findings to be iteratively connected. The results confirm that sustainable value creation is broadly recognised as an aim of the CE, although the term *circular public space* is absent from academic literature. In practice, the concept is acknowledged but mainly reduced to material reuse. Both literature and practice reveal values across environmental, economic, and social dimensions, though social values are most frequently emphasised. Trade-offs between values are currently managed implicitly and ad hoc, with circularity consistently weighed against cost, aesthetics, functionality, and feasibility, causing ambitions to fade as projects progress. To address these shortcomings, the study introduces the Value Trade-off System (VTS), a conceptual framework that structures the identification, prioritisation, and documentation of value trade-offs across project phases. The VTS is not a finished tool but a first conceptual step towards more transparent and accountable decision-making. The study contributes to theory by conceptualising circular public space and advancing understanding of sustainable value creation and value trade-offs, and to practice by providing municipalities with a structured approach to integrate and balance different values in a transparent and accountable way.

Keywords: *Circular public space, Circular Economy, Public space, Sustainable value creation, Value trade-offs, Sustainability dimensions.*

Executive summary in English

Introduction

Municipalities are increasingly expected to integrate circular economy (CE) principles into the development of public space. CE is often linked to sustainability, but how this relation is framed in the literature and how the notion of 'value' is conceptualised remains underexplored. At the same time, municipal practice shows that project decisions are shaped by competing objectives, where value trade-offs are managed informally and without structured guidance. As a result, the definition of circular public space remains unclear, circular ambitions are easily overshadowed by other values and constraints, and decisions are neither transparent nor traceable. The central aim of this study is therefore to examine how value is interpreted and weighed in circular public space, and to develop a conceptual framework to support more structured and transparent value-based decision-making. An overview of the problem statement and objectives is presented in Figure 3.
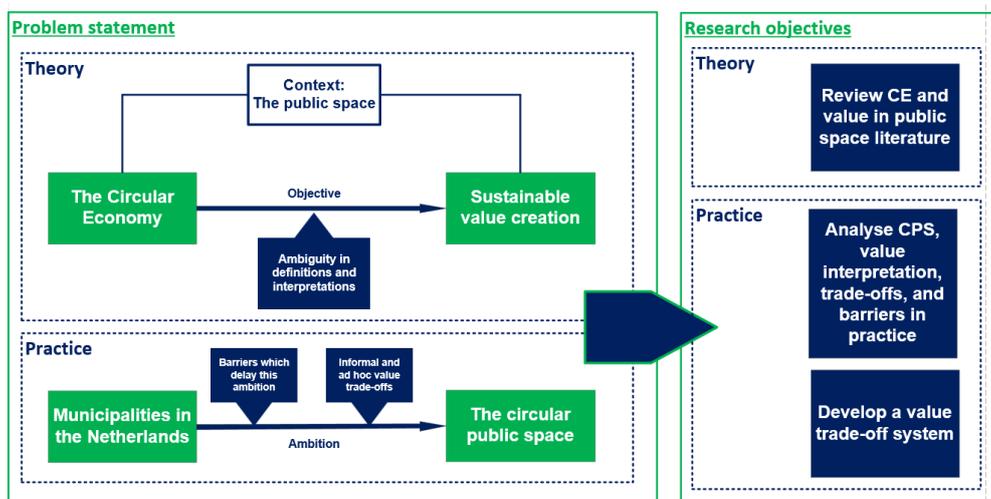

Figure 3 - Overview of the problem statement and research objectives (Own work, 2025).

Methodology

To address this aim, a two-step research design was applied. First, a systematic literature review was conducted to investigate how CE and value are connected in academic literature, with specific attention to environmental, economic, and social dimensions. Second, a qualitative case study was carried out in the Municipality of Rotterdam, focusing on ten semi-structured interviews with municipal professionals involved in public space projects. The data were analysed through an abductive coding approach, which made it possible to iteratively

connect theoretical insights with empirical findings. Principles derived from this process were then used to develop the Value Trade-off System (VTS), a conceptual framework designed to stimulate more explicit and transparent management of value trade-offs.

Results

The literature review confirmed that sustainable value creation is widely framed as an aim of the circular economy. However, the term *circular public space* is absent from academic discourse. Instead, values relevant to circular public space were identified indirectly through studies on public space in the context of circularity and sustainability, resulting in 17 values across the three sustainability dimensions. In practice, the concept is recognised by municipal professionals, but mainly interpreted as the reuse of materials. Across both literature and practice, values were identified in all three dimensions, but social values were most frequently emphasised: 9 out of 17 in literature, and 19 out of 45 in practice. The study further reveals that value trade-offs are managed implicitly and ad hoc. These dilemmas consistently placed circularity on one side, weighed against other values or constraints. As a result, circular ambitions gradually fade as projects progress, and decision-making becomes difficult to evaluate afterwards.

Value Trade-off System

To address the finding that trade-offs are currently made implicitly and ad hoc, this study introduces the Value Trade-off System. The VTS is a conceptual framework that structures decision-making and trade-offs across the different phases of public space projects. It begins with the explicit identification of values and their translation into concrete goals and requirements. It then provides a prioritisation framework to guide choices when different values compete. By embedding values in each project phase and linking them to outputs, the VTS reduces reliance on ad hoc decisions and increases the transparency of the process. The VTS should be understood as a first conceptual step rather than a finished tool, requiring further validation before practical application.

Conclusions

The study concludes that the interpretation of value in circular public space is diverse but strongly centred on social aspects such as participation, inclusivity, and well-being. This contrasts with the general CE literature, where the social dimension is typically underrepresented. By placing CE in the context of public space, social aspects become far more prominent. The VTS enables a more structured and transparent process, supporting municipalities in safeguarding circular ambitions in public space development. In doing so, the study contributes to theory by conceptualising circular public space and proposing a

framework for addressing value trade-offs, and to practice by offering municipalities a structured approach for more transparent and accountable decision-making.

Executive summary in Dutch

Inleiding

Gemeenten worden in toenemende mate geacht principes van de circulaire economie (CE) te integreren in de ontwikkeling van de openbare ruimte. CE wordt vaak in verband gebracht met duurzaamheid, maar hoe deze relatie in de literatuur wordt beschreven en hoe het begrip 'waarde' wordt geconceptualiseerd, blijft onderbelicht. Tegelijkertijd laat de gemeentelijke praktijk zien dat projectbeslissingen worden beïnvloed door concurrerende doelstellingen, waarbij waardeafwegingen informeel en zonder gestructureerde richtlijnen plaatsvinden. Hierdoor blijft de definitie van de circulaire openbare ruimte onduidelijk, raken circulaire ambities gemakkelijk overschaduwd door andere waarden en beperkingen, en zijn beslissingen noch transparant noch herleidbaar. Het centrale doel van dit onderzoek is daarom te onderzoeken hoe waarde wordt geïnterpreteerd en afgewogen in de circulaire openbare ruimte, en een conceptueel raamwerk te ontwikkelen dat meer gestructureerde en transparante waardegedreven besluitvorming ondersteunt. Een overzicht van de probleemstelling en doelstellingen is weergegeven in Figuur 3.
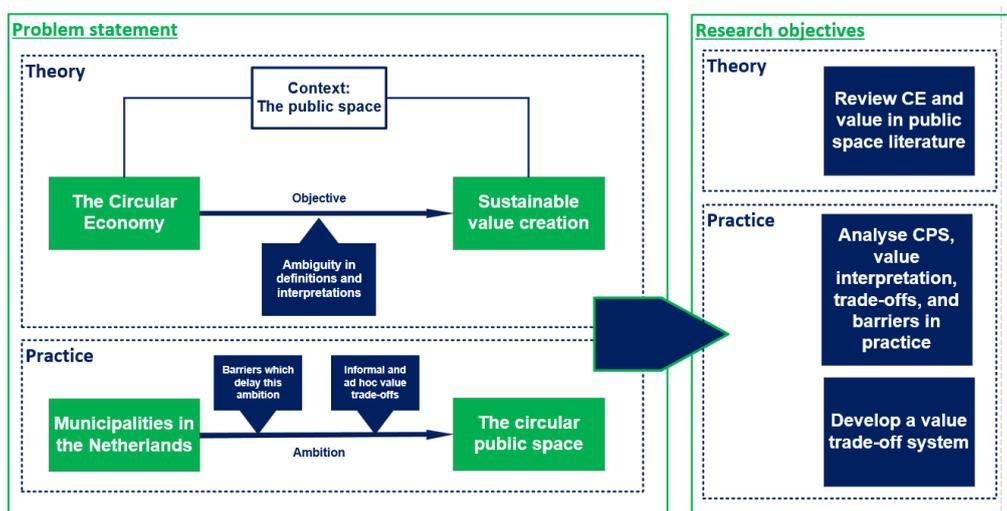
Figuur 3 - Overview of the problem statement and research objectives (Own work, 2025).

Methodologie

Om dit doel te bereiken, is een tweestaps onderzoeksopzet toegepast. Ten eerste is een systematische literatuurstudie uitgevoerd om te onderzoeken hoe CE en waarde in de academische literatuur met elkaar verbonden zijn, met specifieke aandacht voor de

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ecologische, economische en sociale dimensies. Ten tweede is een kwalitatieve casestudy uitgevoerd binnen de gemeente Rotterdam, gericht op tien semigestructureerde interviews met gemeentelijke professionals die betrokken zijn bij projecten in de openbare ruimte. De gegevens zijn geanalyseerd via een abductieve coderingsbenadering, waardoor het mogelijk werd theoretische inzichten iteratief te verbinden met empirische bevindingen. Principes die uit dit proces voortkwamen, zijn vervolgens gebruikt om het Value Trade-off System (VTS) te ontwikkelen, een conceptueel raamwerk dat is ontworpen om explicietere en transparantere omgang met waardeafwegingen te stimuleren.

Resultaten

De literatuurstudie bevestigde dat duurzame waardecreatie breed wordt beschouwd als een belangrijk doel van de circulaire economie. De term circulaire openbare ruimte ontbreekt echter in academische discussies. In plaats daarvan werden waarden die relevant zijn voor de circulaire openbare ruimte indirect geïdentificeerd via studies over de openbare ruimte in de context van circulariteit en duurzaamheid, wat resulteerde in 17 waarden verdeeld over de drie duurzaamheidsdimensies. In de praktijk wordt het concept wel herkend door gemeentelijke professionals, maar voornamelijk geïnterpreteerd in termen van materiaalhergebruik. Zowel in de literatuur als in de praktijk zijn waarden in alle drie de dimensies gevonden, maar sociale waarden werden het meest benadrukt: 9 van de 17 in de literatuur en 19 van de 45 in de praktijk. Het onderzoek laat verder zien dat waardeafwegingen impliciet en ad hoc worden gemaakt. Deze dilemma's plaatsten circulariteit steevast aan één kant, afgewogen tegen andere waarden of beperkingen. Hierdoor vervagen circulaire ambities geleidelijk naarmate projecten vorderen en wordt besluitvorming achteraf moeilijk te evalueren.

Value Trade-off System

Om de bevinding dat afwegingen momenteel impliciet en ad hoc plaatsvinden aan te pakken, introduceert dit onderzoek het Value Trade-off System. Het VTS is een conceptueel raamwerk dat besluitvorming en afwegingen structureert gedurende de verschillende fasen van projecten in de openbare ruimte. Het begint met de expliciete identificatie van waarden en hun vertaling naar concrete doelstellingen en vereisten. Vervolgens biedt het een prioriteringskader om keuzes te begeleiden wanneer waarden met elkaar concurreren. Door waarden in elke projectfase te verankeren en te koppelen aan outputs, vermindert het VTS de afhankelijkheid van ad hoc beslissingen en vergroot het de transparantie van het proces. Het VTS moet worden begrepen als een eerste conceptuele stap en niet als een afgerond instrument, en vereist verdere validatie voordat het praktisch kan worden toegepast.

Conclusies

Het onderzoek concludeert dat de interpretatie van waarde in de circulaire openbare ruimte divers is, maar sterk gericht op sociale aspecten zoals participatie, inclusiviteit en welzijn. Dit staat in contrast met de algemene CE-literatuur, waarin de sociale dimensie doorgaans ondervertegenwoordigd is. Door CE in de context van de openbare ruimte te plaatsen, komen sociale aspecten veel nadrukkelijker naar voren. Het VTS maakt een meer gestructureerd en transparant proces mogelijk en ondersteunt gemeenten bij het waarborgen van circulaire ambities in de ontwikkeling van de openbare ruimte. Daarmee draagt het onderzoek bij aan de theorie door de circulaire openbare ruimte te conceptualiseren en een raamwerk voor waardeafwegingen te introduceren, en aan de praktijk door gemeenten een gestructureerde benadering te bieden voor meer transparante en verantwoorde besluitvorming.

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List of abbreviations

CE	Circular Economy
DMP	Data Management Plan
HREC	Human Research Ethics Committee
IMRaD	Introduction, Methods, Results and Discussion
LCA	Life Cycle Assessment
MRQ	Main Research Question
PII	Personally Identifiable Information
PIRD	Personally Identifiable Role Descriptions
PvE	Programma van Eisen (Project Requirements Document)
SD	Sustainable Development
SLR	Systematic Literature Review
SRQ	Sub-Research Question
TBL	Triple Bottom Line
ToL	Trade-off Ledger
UN-Habitat	United Nations Human Settlements Programme
UNEP FI	United Nations Environment Programme Finance Initiative
VTS	Value Trade-off System

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1. Research Introduction

1.1 Background information

This section serves as an introduction before stating the problem statement. Section 1.1.1 introduces the concept of the circular economy (CE) and its role as a value-creation model. Section 1.1.2 outlines the policy context of CE in the Netherlands. Section 1.1.3 highlights public space as a potential but underexplored domain for CE.

1.1.1 Circular economy and value creation

The circular economy (CE) is gaining increasing attention as a new approach to support sustainable development. Instead of the traditional linear model where resources are extracted, used, and then discarded, a CE keeps materials in circulation for as long as possible. In a circular model, resource loops are closed and slowed through circular strategies like reducing consumption, reusing products, and recycling materials, thereby minimising waste and reducing the need for new resource inputs (Bonciu, 2020).
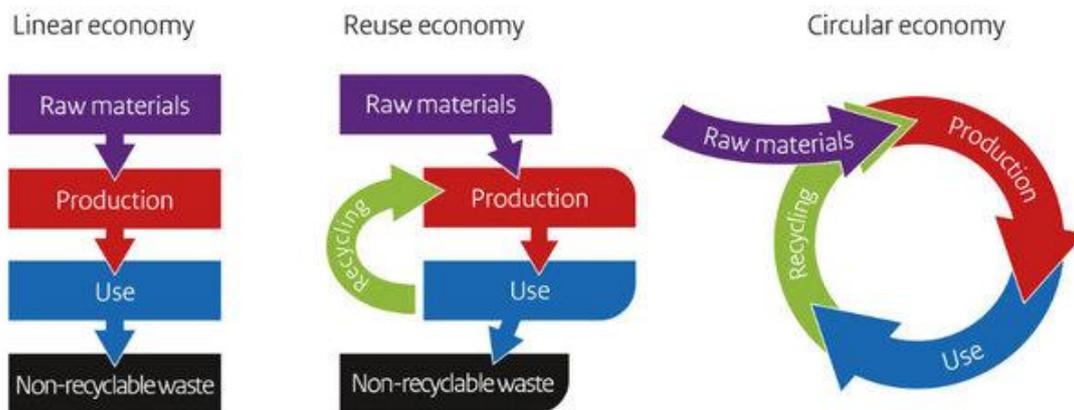
Figure 1 - Difference between the Linear economy and the Circular economy (Bonciu, 2020).

The aim of a circular economy (CE) is more than improving resource efficiency. A CE also seeks to generate sustainable value across multiple domains. In their analysis of 114 definitions, Kirchherr et al. (2017) found that a significant portion explicitly framed CE as a value-generating model, mostly divided into the three pillars of sustainability: environmental, economic and social. Rather than focusing solely on waste reduction or material reuse, CE is

increasingly recognised as a systemic approach to long-term sustainability. Velenturf and Purnell (2021) argue that CE should be understood as a value-optimisation strategy that supports the transition to more sustainable production and consumption systems. As illustrated in Figure 2, the CE model aims to regenerate natural systems while minimising resource input and maximising waste prevention. sustainability targets and aligning economic systems with long-term ecological and societal goals.
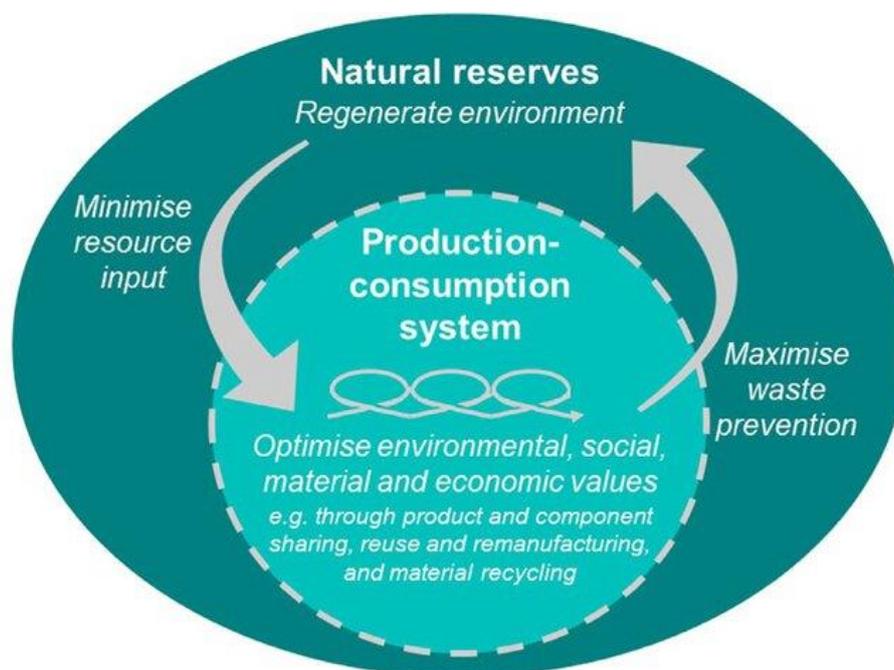
Figure 2 - The circular economy as a value optimisation model (Velenturf & Purnell, 2021).

At its core lies the goal of optimising environmental, social, and economic values through R-strategies like reuse, remanufacturing, and recycling.

By viewing CE as a value-optimisation system, the focus shifts from simply closing material loops to making conscious trade-offs between competing goals. This creates new challenges for governance, especially in domains where environmental, economic, and social considerations intersect. One important domain is the development of public space, which has traditionally been overlooked in circular economy discourse, despite its central role in shaping the physical and social fabric of urban life.

1.1.2 The position of CE in the Netherlands

In the Netherlands, the circular economy has been embraced as a key pillar of long-term sustainability policy. The national programme *Nederland Circulair in 2050*, launched by the Dutch government, outlines an ambitious strategy to reduce the use of primary raw materials by 50% by 2030, with the ultimate goal of achieving a fully circular economy by 2050 (Rijksoverheid, n.d.). This vision frames circularity as a systemic transition that requires changes across various sectors, including construction, manufacturing and other sectors. Within this policy framework, municipalities are expected to play a central role in implementation. Cities, in particular, are regarded as both drivers and testing grounds for circular innovation. The reason behind this is their concentration of material flows, infrastructure, and socio-political complexity.

Governments are therefore encouraged to imply CE in their spatial development strategies. However, while strategic visions and high-level goals have been clearly articulated, the operationalisation of CE at the municipal level remains a work in progress. Translating circular ambitions into practical interventions continues to be a challenge. This is especially the case in spatial domains such as public space, where multiple stakeholders play a role. Because of that, there is a need to understand how CE principles are being interpreted and applied in urban contexts, and how public space fits within this broader policy transition.

1.1.3 Public space as a value creation domain

While the circular economy has gained traction in domains such as industry, construction, and waste management, public space has received comparatively little attention (Li, 2025; Pekdemir, 2025). This is surprising given the central role that public space plays in cities: it encompasses large-scale material flows, long-term maintenance cycles, and highly visible interventions that shape the urban environment. Moreover, public space is a site with a potential where a wide range of values could come together. It is not only a physical setting, but also a carrier of public meaning and collective identity.

1.2 Problem statement

As part of the broader transition towards a circular economy (CE), municipalities are increasingly expected to apply circular principles in public space development. In academic literature, CE is framed as a strategy for generating sustainable value. However, the meaning of 'value' in the context of circularity in public space is conceptually ambiguous. Although

CE is linked to value creation, it is unclear how value is defined, interpreted, and prioritised in public space.

In practice, project decisions are shaped by multiple and often competing objectives. Yet it remains uncertain how CE informs these decisions, and how value considerations are identified and addressed. There is limited shared language or structured guidance for integrating CE and value in public space development.

The consequence is that CE in the public space risks reaching its full potential, disconnected from broader value-based objectives. Without conceptual clarity and structured decision-making, value-based trade-offs are made informally and unconsciously, undermining consistency, transparency, and the integration of CE in public space development. When decisions are not explicitly framed in terms of value, it becomes difficult to evaluate their rationale, and this limits opportunities for learning, accountability, and improvement in future projects.

1.3   Knowledge gap

In the scope of this study, two main knowledge gaps play a clear role in confirming the relevance of the problem statement and research objective.

Firstly, there is a gap in understanding the relationship between CE and value creation across the different domains. Various studies indicate that CE is often limited to the practical and technical levels of the physical flows of materials, and that the broader implication of CE is and remains underexplored (Korhonen et al, 2018; Murray et al, 2017; Kircherr et al., 2017). These studies recommend an inclusion of all the dimensions of sustainable value creation in the definitions and implementation of CE in general.

There is also a second practical gap in the implementation of CE principles in the specific public space sector. This is based on a systematic literature review in Scopus and Google Scholar. The idea of a 'circular public space' (CPS) seems to be which is not well defined or investigated. On the other hand, other sectors than the public space are more developed and present in the CE literature. For instance, the application of the CE in the construction or built environment sector is receiving growing academic attention (Benachio et al., 2020; Gasparri et al., 2023).

These knowledge gaps will be filled with the collected data and the outcomes of this study.

1.4 Research objectives

Acknowledging the knowledge gap regarding the role of value in the circular public space, this study aims to develop a value trade-off system to support more structured and transparent decision-making in this context.

To achieve this aim, the research pursues the following objectives:

1. To review academic literature on the circular economy and value in the context of public space development.
2. To understand how value is interpreted in practice, how trade-offs are made between different values, and which barriers influence this process in circular public space projects.
3. To develop a value trade-off system that supports more consistent and transparent value-based decision-making in future circular public space development.

Because the problem statement and research objectives encompass both a theoretical and a practical dimension, they may appear a little bit complex. Therefore an illustration (Figure 3) was made to provide a clear overview.
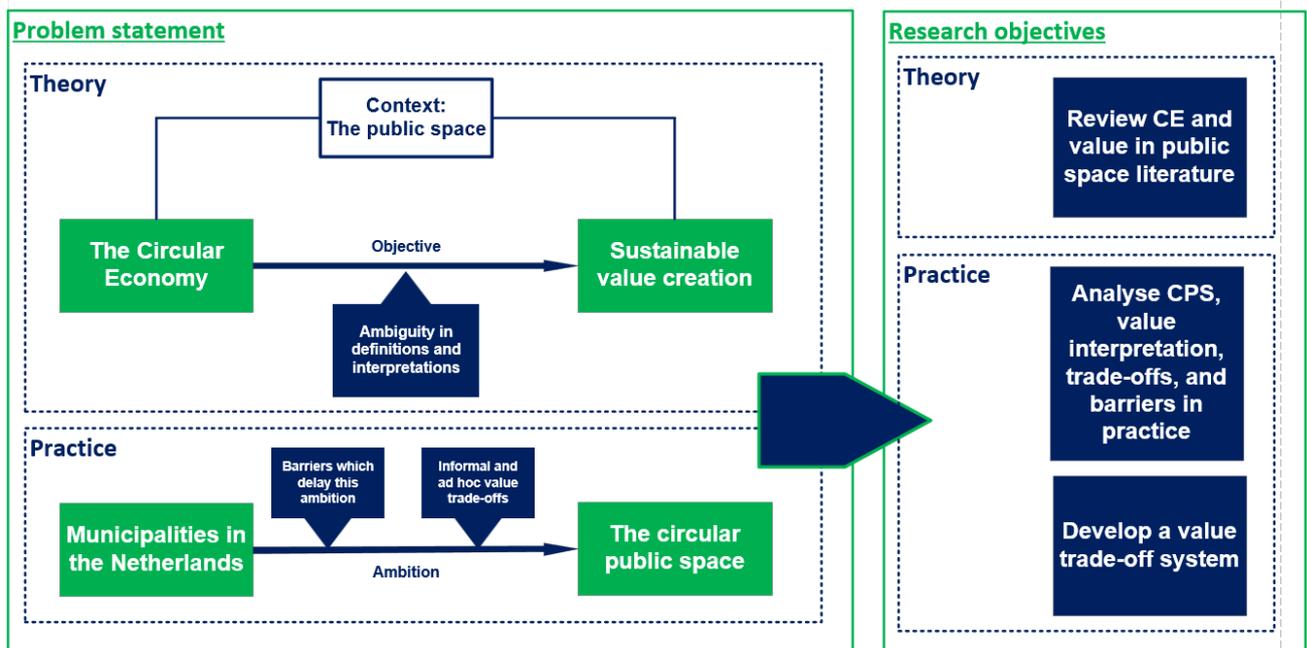
Figure 3 - Overview of the problem statement and research objectives (Own work, 2025).

1.5   Research questions

Based on the problem statement and the research objective, the following main research question (MRQ) is formulated:

How can value trade-offs be understood and supported in the development of circular public space projects?

To guide the investigation and provide a structured response to the main research question, the following sub-research questions (SRQ) have been formulated:

SRQ1: *To what extent is circular economy linked to sustainable value creation?*

SRQ2: *How is value conceptualised in academic literature relevant to circular public space?*

    a. *How is the circular public space defined in academic literature?*

    b. *How are values in the circular public space described in academic literature?*

    c. *How are value trade-offs in the development of the circular public space described in academic literature?*

SRQ3: *How is the circular public space interpreted in practice, and what values are associated with it?*

SRQ4: *How are trade-offs between different values made in the development of the circular public space, and what barriers influence this process?*

1.6   Research relevance

This research addresses both a scientific and a practical gap in the application of circular economy (CE) principles within the public space.

From a scientific perspective, the study responds to the lack of conceptual clarity around the meaning of 'value' in the context of circular public space. While CE is often described as a value-generating model, academic literature rarely defines how different values (environmental, social, or economic) are interpreted or weighed in this specific domain. As such, this research contributes to ongoing academic debates on the operationalisation of CE

by clarifying how value-based decision-making plays a role in the design and implementation of CE in the public space.

From a practical perspective, municipalities are increasingly expected to incorporate CE ambitions into public space development, but often lack structured guidance for doing so. Decisions are commonly made without a shared framework, leading to informal trade-offs between conflicting project goals. This study aims to support municipal practice by developing a value trade-off system that can improve the consistency, transparency, and accountability of value-based decision-making in circular public space projects.

By addressing these two gaps, the research is relevant to both academic and professional audiences. It offers theoretical insights into value interpretation and trade-offs, while providing practical tools to support better decision-making in real-world projects.

1.7   Research demarcation

This research focuses on the interpretation and application of circular economy principles in outdoor public space within the Dutch municipal context. It is limited to value-based decision-making and does not assess the full range of circular strategies or their technical performance. The study does not aim to evaluate whether projects are circular according to specific technical indicators, but rather investigates how practitioners define, weigh, and navigate circular ambitions and competing values in the public space. The research relies on qualitative methods (systematic literature review and semi-structured interviews) and does not include quantitative impact assessments such as life cycle analysis (LCA) or other forms of assessment methods.

1.8   Thesis outline

This thesis consists of seven chapters, divided into three main parts. Chapter 1 introduces the research background, problem statement, knowledge gap, research aim, and research questions. Chapter 2 presents the literature review and addresses the first two sub-questions by examining how value is conceptualised in academic literature on circular public space. Chapter 3 outlines the research methodology, including the research design, literature review process, interview strategy, and data analysis procedures.

Chapter 4 presents the empirical findings from the interviews, answering the third and fourth sub-questions concerning how circularity is interpreted in practice, which values are

considered, and how trade-offs are made. Chapter 5 addresses the fourth sub-question by developing a value trade-off system based on the insights gathered from both literature and practice.

In Chapter 6, the findings are discussed in relation to the theoretical background, and reflections are provided on the system's applicability, the study's limitations, and implications for future research. Chapter 7 concludes the thesis by answering the main research question and summarising the key insights.

To support the reader in understanding the structure of the thesis, the report is organised according to the IMRaD model (Introduction, Methods, Results, and Discussion). This model is a logical sequence that corresponds to the steps of the scientific research process (CGU Writing Centre, n.d.). As is presented in Figure 4, the chapters are divided into three parts:

- Part A – Foundation (Chapters 1–3): builds the conceptual and methodological basis.
- Part B – Findings (Chapters 4–5): presents the empirical results and the value trade-off system.
- Part C – Reflection (Chapters 6–7): interprets the findings and formulates final conclusions.
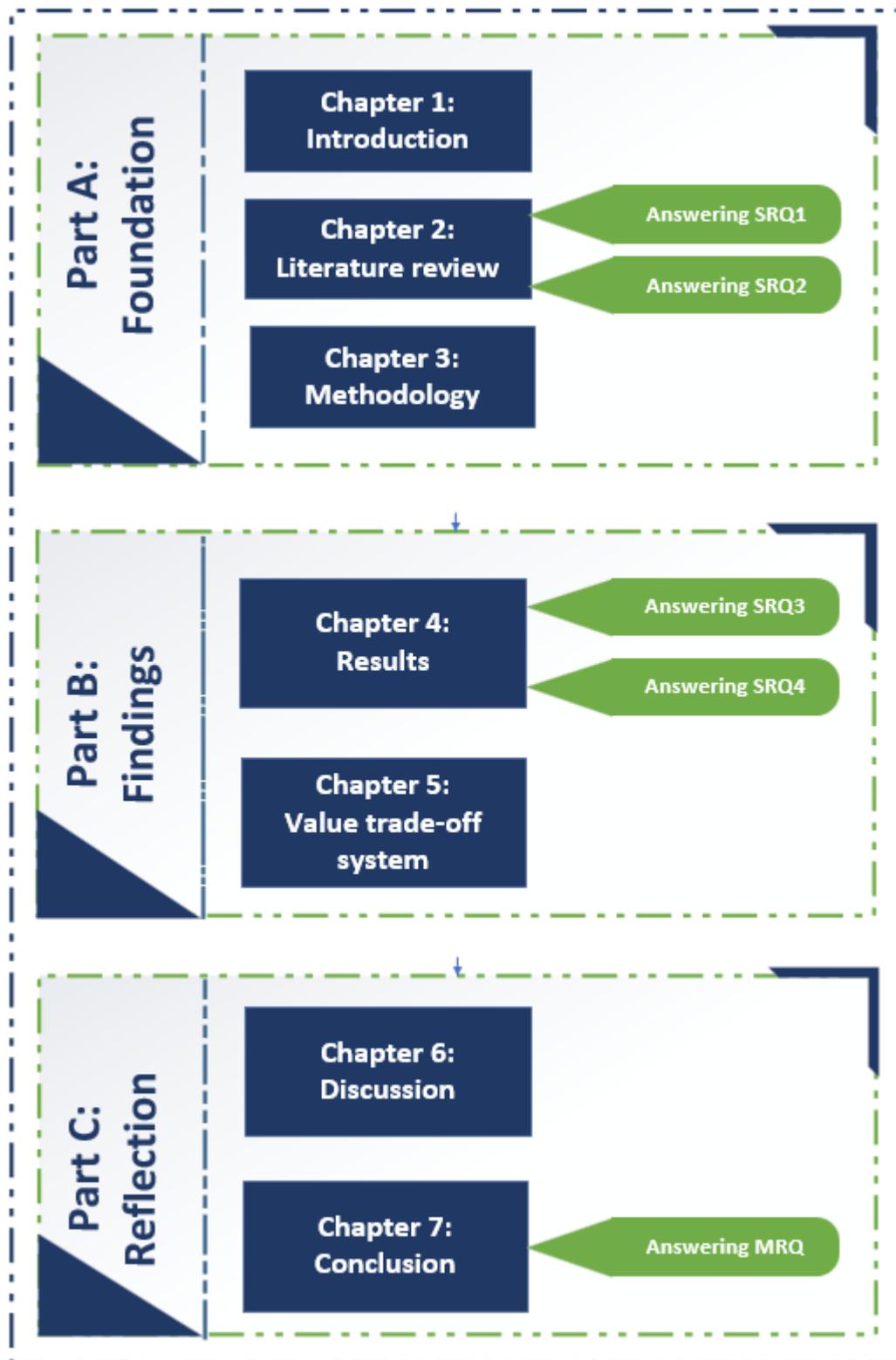
Figure 4 - Thesis Outline and chapter overview (Own work, 2025).

2. Literature review

2.1 Introduction to the literature review

This chapter presents the academic literature review on value creation in the circular public space. The aim of this chapter is to clarify the key concepts of the research which will serve as the foundation for the empirical study. By doing so, the first two sub-research questions will be answered:

SRQ1: *To what extent is the circular economy linked to sustainable value creation?*

SRQ2: *How is value conceptualised in academic literature relevant to circular public space?*

    a. *How is the circular public space defined in academic literature?*

    b. *How are values in the circular public space described in academic literature?*

    c. *How are value trade-offs in the development of the circular public space described in academic literature?*

Three core concepts in this study are identified in this study and require a deeper understanding before performing the Systematic Literature Review:

- The circular economy
- Sustainable value creation
- The public space

By clarifying and explaining the three core concepts written above, the first SRQ will be answered. As for the second SRQ, a systematic literature review is conducted. The methodology of this SLR is described section 3.3.

The structure of this chapter follows the distinction between the theoretical background and the systematic literature review (SLR). The theoretical background addresses the three core concepts. In this part, several preparatory decisions for the SLR are also made, such as the choice to use the term *value* rather than *sustainable value*. The SLR then builds on this foundation to address SRQ2, focusing on the description of circular public space, the identification of values, and the exploration of value trade-offs in the literature. Figure 5

provides an overview of how the chapter sections are organised in relation to the sub-research questions.
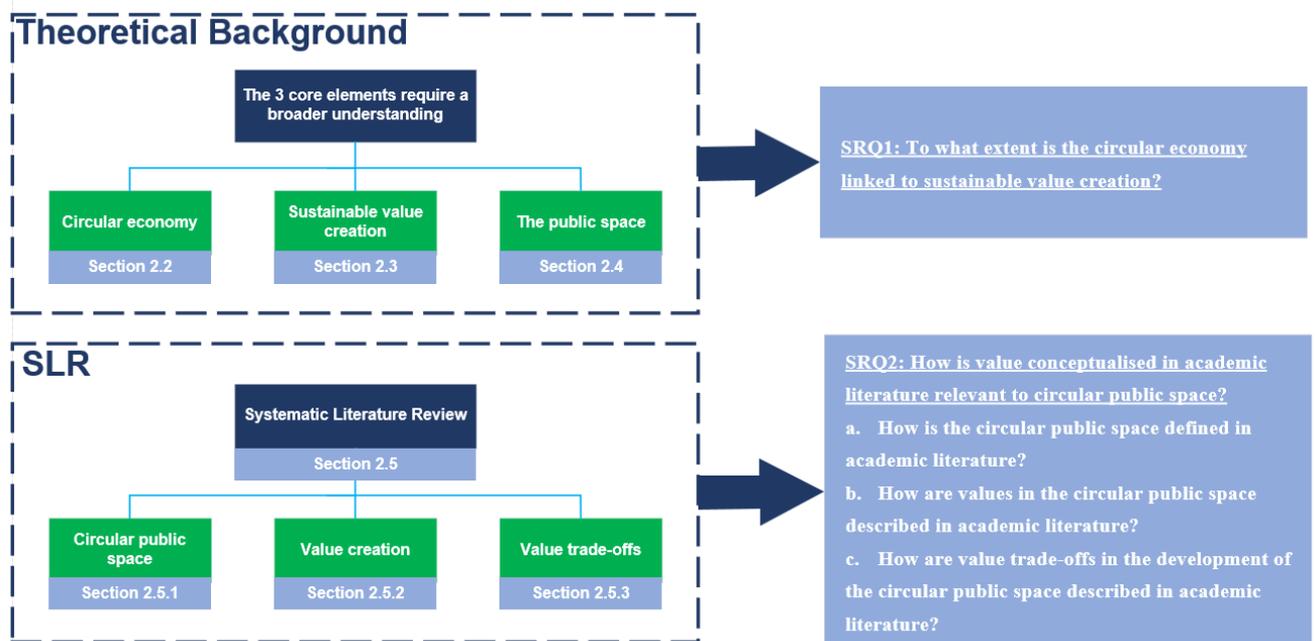
Figure 5 – Literature review structure and link with the sub-research questions (Own work, 2025).

2.2   The circular economy

The circular economy (CE) is gaining more attention in recent years. A keyword study in the database Scopus, which was performed in 2023, proves the massive growing attention. In 2008, only 54 articles were published with the presence of the keyword 'circular economy'. In 2022, the results exceeded 6000 hits (Rada, 2023). This shows the explosive growth of CE in academic literature the last years. The results are illustrated with the blue bars in Figure 6.
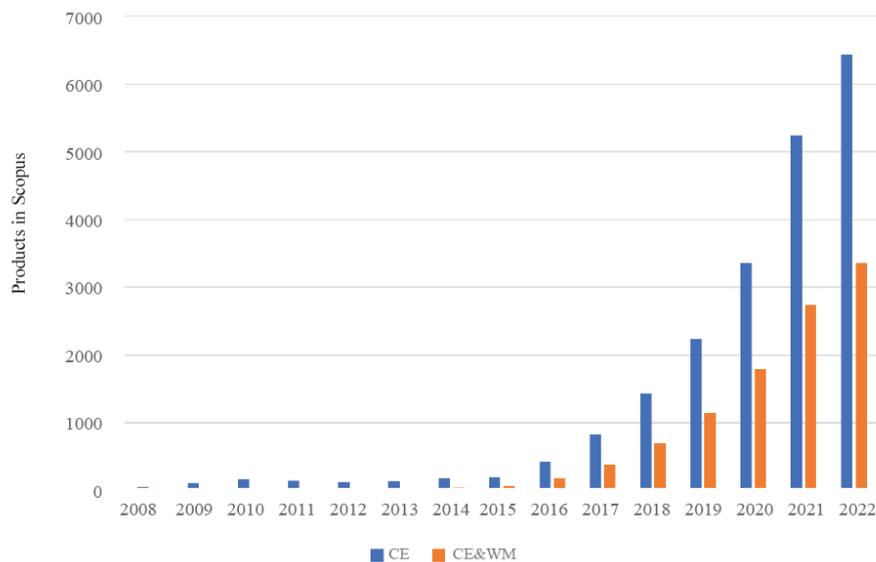
Figure 6 - Number of hits in Scopus with keyword 'circular economy', illustrated in the blue bars (Rada, 2023).

A lot of research has been done in the origin and development of CE (Maguire & Robson, 2023; Maksymiv et al., 2021; Winans et al., 2017; Stahel, 2020). The studies show that how the development of CE has been shaped is not something which is agreed upon. It is stated that first schematic description of CE has been given by W. Stahel in 1982 (Maksymiv et al., 2021).
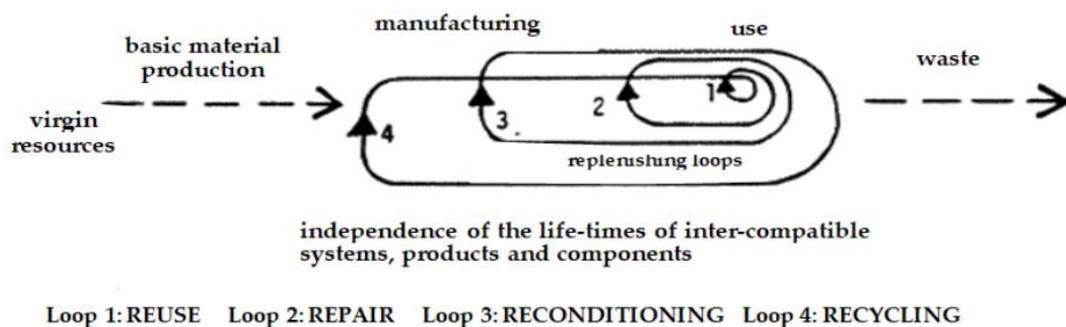
Figure 7 - An early schematic description of a circular economy (Maksymiv et al., 2021).

As can be seen in Figure 7, CE was initially not framed or linked with sustainable development or value creation. However, over time the concept has evolved and is now strongly connected to sustainability goals. Recent definitions, which will be presented in the next section, consistently emphasise CE as a model for creating environmental, economic, and social value, positioning it as a driver of sustainable development rather than merely a

waste management strategy. In this way, CE has shifted from a technical focus to a broader framework for value optimisation and long-term societal benefit.

2.3 Sustainable value

To understand how the CE is linked with sustainable value creation, this subsection presents a selection of CE definitions. The aim is to assess the extent to which these definitions incorporate the idea of sustainable value creation and thereby answering the first SRQ. In Section 2.3.1, a range of definitions is collected from academic literature and institutional frameworks. To distinguish the part of the definition which is relevant from the other parts, the words that refer to sustainable value creation have been highlighted in bold. In Section 2.3.2, these definitions are analysed for RSQ1. The findings are delimited to fit in the scope of this study, which focuses on value creation in the circular public space.

2.3.1 Sustainable value creation in CE definitions

As explained in the previous section, the circular economy (CE) has gained significant attention across academic, policy, and business domains. As a result, a wide range of definitions has emerged. While some definitions focus primarily on material loops or waste reduction, other definitions adopt a broader sustainability perspective that incorporates multiple dimensions. This diversity has enriched the conceptual depth of CE, but also created ambiguity and uneven application in practice.

One of the most prominent studies in this field, is the study of Kircherr et al. (2017). They analysed 114 CE definitions and concluded that the following definition serves as the best definition for future research:

'A circular economy describes an economic system that is based on business models which replace the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operating 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, which implies creating environmental quality, economic prosperity and social equity**, to the benefit of current and future generations.'

In their revisited analysis from 2023, the link between CE and sustainable development (SD) is further emphasised by their conclusion '**sustainable development** is frequently considered

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the **principal aim** of CE' (Kircherr et al., 2023). As can be seen in Figure 8, SD is divided into the three pillars: environmental, economic and social.
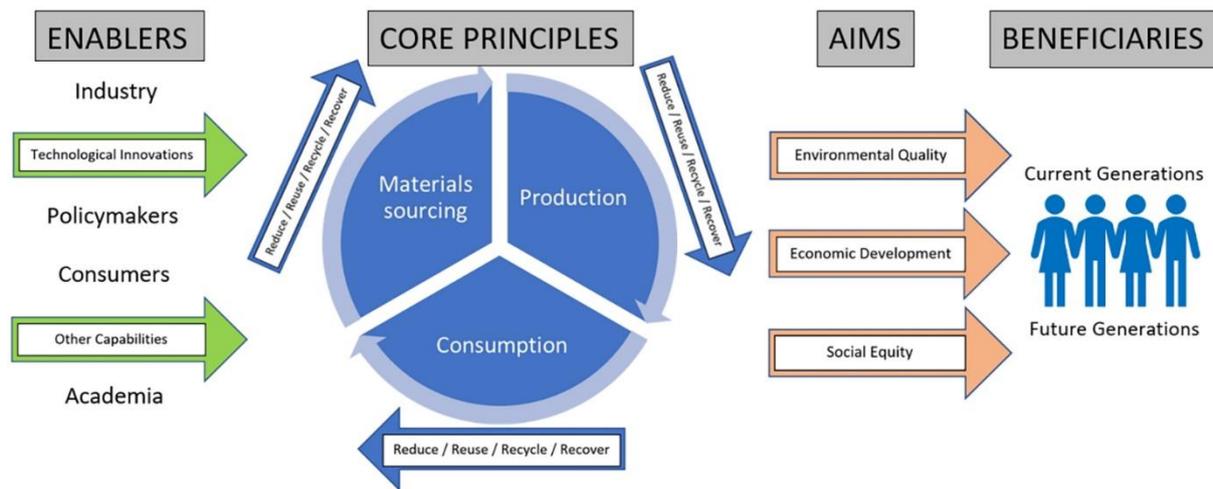
Figure 8 – The aims of the CE presented in the three pillars: Environmental, Economic, Social. (Kircherr et al., 2023).

The Ellen MacArthur Foundation describes the circular economy as 'a systemic approach to **economic development** designed to benefit businesses, **society, and the environment**' (Ellen MacArthur Foundation, 2019). The foundation adds that CE 'A favours activities that **preserve value** in the form of energy, labour, and materials'.

In another study in which CE definitions were analysed, it is explained that CE was not linked that much to sustainable development In the 90s, but now is considered a 'mainstream strategy for product design and **social, economic and environmental sustainability**' and as a 'a practice of maximum utilization of material use across the whole life-cycle as well as **deliver value**'.

Not only academic, but also policy agencies like the European Parlement define CE as a model for creating sustainable value. In their definition it is stated that CE 'implies reducing waste to a minimum. When a product reaches the end of its life, its materials are kept within the economy wherever possible thanks to recycling. These can be productively used again and again, **thereby creating value**' (European Parliament, 2023).

In the UN environmental program is CE introduced as a 'model which increases **environmental** resilience with substantial **economic and societal benefits** such as job creation and innovation, increased competitiveness, enhanced resilience of businesses, cost

savings as well as improved social equity and well-being by ensuring a just transition for all communities affected' (UNEP FI, n.d.).

2.3.2 Sustainable value creation in the scope of this study

The analysis of the found definitions in Section 2.3.1 shows that the link between the circular economy (CE) and sustainable value creation is widely acknowledged across academic, policy, and institutional sources. Although the exact phrasing and emphasis vary, there is no doubt that sustainable value creation is a an aim of CE.

In most definitions, sustainable value creation is expressed through the familiar framework of the three pillars of sustainability: environmental, economic, and social. The division in these three dimensions was initiated by Elkington in 1997 by his Triple Bottom Line (TBL). The TBL expresses the expansion of the environmental ambitions in a way that integrates the economic and social outcomes (Elkington, 1997). Some definitions prioritise environmental outcomes such as reducing emissions or closing material loops, while other highlight the other economic and social dimensions of sustainability. This division of the three dimensions is the reason why specific search-keywords were used during the SLR. This process in method is explained in detail section 3.3.2.

There is also an inconsistency in the terminology used to express the aim of sustainable value creation. Terms such as *sustainable development*, *sustainability*, *value creation*, *environmental quality*, *economic prosperity, social equity,* and *environmental/economic /social benefits* are used without clear definitions or boundaries. As a result, while the general intent to contribute to long-term value is shared, the way it is conceptualised and communicated differs significantly across contexts.

Given this variation, this report deliberately adopts the broader and more neutral term 'value' rather than 'sustainable value' or 'sustainable development', before performing the systematic literature review to answer RSQ2. The field of the circular economy (particularly in relation to public space) is still emerging and under-theorised. Therefore, using a broader term allows the research to capture a wider range of interpretations without prematurely narrowing the analytical scope. For the purposes of this thesis, value will be understood and discussed through the lens of the three pillars of sustainability (environmental, economic, and social).

2.3.3 Definitions of the three sustainability dimensions in circular public space

Sustainability is commonly conceptualised through the three-pillar model, which distinguishes between environmental, economic, and social dimensions. This model is widely applied in both academic and policy contexts because it provides a balanced framework for assessing the multiple objectives of sustainable development. For the purpose of this thesis, the three-pillar model is adopted as a conceptual basis to structure the interpretation of sustainable value in circular public space. It offers a consistent way to distinguish between different types of value and ensures that environmental, economic, and social considerations are each explicitly addressed. By grounding the analysis in these three dimensions, the study creates a clear framework for comparing insights from the literature with findings from practice and for examining how different types of value interact in trade-offs.

- The environmental dimension is defined as the ability to preserve ecosystems and natural resources in a way that safeguards their integrity for present and future generations (EcoActiveTech, 2024).
- The economic dimension is defined as the pursuit of growth and development under conditions that maintain long-term financial viability and resource efficiency (EcoActiveTech, 2024).
- The social dimension is defined as the maintenance and enhancement of societal justice, equity, and collective well-being (EcoActiveTech, 2024).

2.4 The concept of public space

The third and last core element of this literature review which requires a broader understanding before presenting the results of the SLR, is the public space. Also this term is defined ambiguous in academic literature (Zhang & He, 2020). Various studies have attempted to clarify the definitions of public space. The most essential part that makes a public space public, is the concept of publicness. Publicness is a multidimensional concept and consists of both a legal sense and a lived sense. A legal sense is primarily defined by ownership. A lived sense encompasses the other three dimensions: accessibility, inclusiveness, and management (Li et al., 2022). As illustrated in Figure 9, these dimensions form the foundation for synthesising publicness and guiding efforts toward an ideal public space.
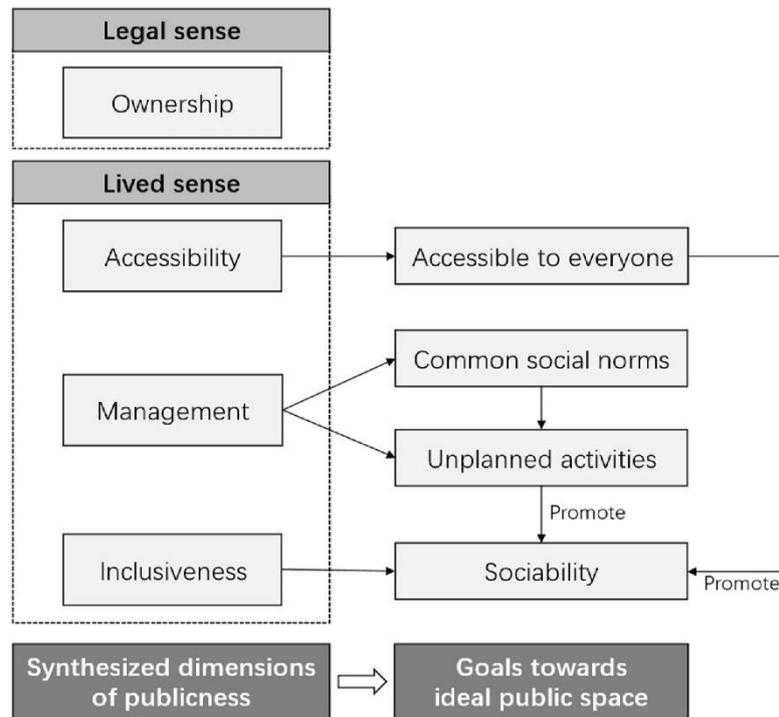
Figure 9 - The four dimensions of publicness in the public space (Li et al., 2022).

A widely accepted definition comes from the Charter of Public Space, which defines public spaces as 'all places publicly owned or of public use, accessible and enjoyable by all for free and without a profit motive' (UN-Habitat, 2018). It also highlights four key typologies in the public space: streets, open public spaces, public facilities, and markets.

Streets are defined as thoroughfares that are based inside towns, cities and neighbourhoods. Streets offer an essential urban function: mobility. They are public spaces because of their being publicly-owned and maintained, accessible and enjoyable by all, mostly without charge and at all hours (UN-Habitat, 2018).

Public Open Spaces are defined as undeveloped land or land with no structures or buildings that is accessible to the public, and that provides recreational areas for residents and helps to enhance the beauty and environmental quality of neighbourhoods Types of open public space vary across cities and can broadly include parks, gardens, playgrounds, public beaches, riverbanks and waterfronts (UN-Habitat, 2018).

These two key categories form the basis of how *public space* is understood in the scope of this study. By focusing on streets and public open spaces, the research concentrates on the areas where municipalities most directly influence spatial design, material use, and long-term planning. These types of spaces are not only physically prominent in the urban environment, but also serve as critical settings for delivering value.

> **In short, the public space in this study is defined as outdoor areas that are publicly accessible, like streets, parks, green areas, gardens, playgrounds, yards, green areas and recreational areas, with the potential to generate value in these spaces.**

2.5 The circular public space: Results of the Systematic Literature Review

To answer SRQ2, a systematic literature review (SLR) was conducted, for which the methodology is explained in detail in Section 3.3. The previous three sections provided the theoretical background necessary before performing the SLR. For example, this was needed to determine which keywords to use during the search process. This section is divided into three subsections. Subsection 2.5.1 presents the results on how the concept of the circular public space is described in academic literature. Subsection 2.5.2 focuses on the different types of values that play a role in the circular public space. However, as can be seen in the title, the term *public space* is used instead of *circular public space*. This is because the concept of circular public space is not used in literature, and the sources that do discuss CE or sustainability in relation to space often use more general terminology. Therefore, academic sources that refer to public space in the context of CE or sustainability were included. As these sources do not explicitly refer to circular public space, the broader term public space is used when identifying and categorising the values. This selection process and the applied search strategy are further explained in Section 3.3 and visualised in Figure 12. Finally, Subsection 2.5.3 presents the value trade-offs found during the SLR.

2.5.1 The circular public space

The term *circular public space*, with this specific wording, is not found in academic literature. A SLR was conducted to investigate how the circular public space is described. However, none of the reviewed sources used this term explicitly. This makes it even more relevant to

explore whether the term is recognised in practice, and if so, how it is interpreted and described by professionals.

2.5.2 Value creation in the public space

The literature review identified a range of environmental, economic, and social values associated with public space, as reported across diverse academic and professional studies. To provide clarity and comparability, the findings are summarised in three separate overview tables, each corresponding to one of the sustainability dimensions. For every value identified, the type of public space studied, the research method applied, and the source are specified.

Table 1 - Environmental values identified in the public space (Own work, 2025).

#	Environmental value identified	Explanation if the definition of the value is abstract or not obvious	Type of public space in the source	Research method of the study	Source[1]
1.	Physical Environmental Comfort	Maintaining a sound environment free from noise pollution, ensuring adequate sunlight and ventilation, and providing fresh air with comfortable temperatures.	Outdoor public space	Case study of a country	Yang et al., (2023)
2,	Ecological sustainability	Outdoor space is ecologically balanced, with healthy environment, diverse, and ecosystem, and rationally used resources.	Outdoor public space	Case study of a country	Yang et al., (2023); Jung et al. (2025)
3.	Pollution reduction	This value is self-exploratory.	Historic urban areas	Systematic literature review and expert validation	Zhao et al. (2023)
4.	Natural resources conservation and restoration	Protection, responsible use, and regeneration of natural systems and materials.	Historic urban areas	Systematic literature review and	Zhao et al. (2023)

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[1] The first-mentioned source is the leading one. This source defines the explanation of the value, the method of the study, and the type of public space. The sources listed afterward have been added to demonstrate that this value or its meaning is also mentioned in those sources. This applies to Table 1, 2 and 3.

#		Explanation	Type of public space in the source	Research method of the study	Source
				expert validation	
5	Biodiversity	the variety of plant and animal life.	Urban public spaces in general	Narrative literature review and spatial analysis	Jung et al. (2025)

Table 2 - Economic values identified in the public space (Own work, 2025).

#	Economic value identified	Explanation if the meaning of the value is abstract or not obvious	Type of public space in the source	Research method of the study	Source
1.	Financial sustainability	The resources in the outdoor space are planned reasonably in the early stage and used in the later stage without any waste.	Outdoor public space	Case study of a country	Yang et al., (2023)
2.	Economic viability	This value means financial support and attraction of investors.	Historic urban areas	Systematic literature review and expert validation	Zhao et al. (2023)
3.	Economic vitality	This value consists out of: Job opportunities, traditional business development and local compatibility.	Historic urban areas	Systematic literature review and expert validation	Zhao et al. (2023)

Table 3 - Social values identified in the public space (Own work, 2025).

#	Social value identified	Explanation if the definition of the value is abstract or not obvious	Type of public space in the source	Research method of the study	Source
1.	Spatial Functionality	The framework highlights multifunctionality, adequate scale, inclusivity for all ages, and adaptability to different climates and times.	Outdoor public space	Case study of a country	Yang et al. (2023)
2.	Spatial Safety	The framework identifies four safety indicators for outdoor spaces: daily safety from hazards and traffic, disaster prevention	Outdoor public space	Case study of a country	Yang et al. (2023)`; Zhao et al. (2023); Bambó

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		capabilities, protection against crime, and maintenance of hygienic conditions.			Naya et al. (2023)
3.	Spatial Diversity	This value stresses diversity in spatial layering, form, and scale, ensuring varied transitions, multiple spatial types, and areas suited for both groups and individuals.	Outdoor public space	Case study of a country	Yang et al. (2023)
4.	Spatial Accessibility	This value can be explained as spatial attraction, clear and direct pathways, and concentrated layouts of functional spaces to enhance usability and appeal.	Outdoor public space	Case study of a country	Yang et al. (2023); Zhao et al. (2023);
5.	Cultural sustainability	Outdoor space reflects regional cultural characteristics.	Outdoor public space	Case study of a country	Yang et al. (2023)
6.	Social well-being	This value is self-exploratory.	Historic urban areas	Systematic literature review and expert validation	Zhao et al. (2023)
7.	Public awareness and perception	This value is self-exploratory.	Historic urban areas	Systematic literature review and expert validation	Zhao et al. (2023)
8.	Community involvement (Also called participation / social cohesion in other sources)	This value is self-exploratory.	Historic urban areas	Systematic literature review and expert validation	Zhao et al. (2023); Bambó Naya et al. (2023); Jung et al. (2025)
9	Inclusiveness	Ensuring equal representation for diverse groups in public space.	Urban areas	Case study of urban project in Spanish cities	Bambó Naya et al. (2023)

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The frameworks from the sources can be found in Appendix A.

2.5.3 Value trade-offs

The final part of the literature review focuses on value trade-offs. These trade-offs refer to situations where different values come into conflict during decision-making processes. When analysing the data collected through the SLR, no explicit mention of value trade-offs was found. This outcome was in line with expectations, as informal trade-offs are typically part of the practical reality of project development rather than a concept that is well-defined in academic literature. Nonetheless, identifying the absence of trade-off discussions in the literature helps to further justify the focus of this study on understanding how such decisions are made in practice.

3. Methodology

3.1   Introduction to the methodology

This chapter presents the methodological approach adopted to answer the research questions of this study. Given the emerging and underexplored nature of the topic, a qualitative and exploratory strategy was selected. This allows for a rich, in-depth understanding of both theoretical perspectives and practical realities, rather than relying on pre-determined models or quantitative measurement alone.

The chapter is structured into three main sections. Section 3.2 outlines the overall research design, explaining the rationale for the qualitative, exploratory approach and the complementary use of primary and secondary methods. Section 3.3 describes the systematic literature review (SLR) process, including how relevant academic sources were identified, screened, and analysed to form the theoretical foundation for the study. Section 3.4 details the empirical research methodology, encompassing the case study design, interview protocol development, participant selection, data collection, and the coding and analysis procedures.

By combining the structured review of academic literature with empirical insights from municipal professionals in the case of Rotterdam, the methodology ensures both conceptual grounding and contextual relevance. This integrated approach strengthens the validity of the findings and supports a well-rounded response to the study's research questions.

3.2   Research design

This study is qualitative and exploratory in nature. Exploratory research is a methodology approach that investigates research questions that have not previously been studied in depth, and is often qualitative and primary in nature (George, 2023). The goal of such a research is to explore the problem and around it and not necessarily derive a conclusion from it (Bhat, n.d.). As illustrated in Figure 10, exploratory research is characterised by primary and secondary methods.
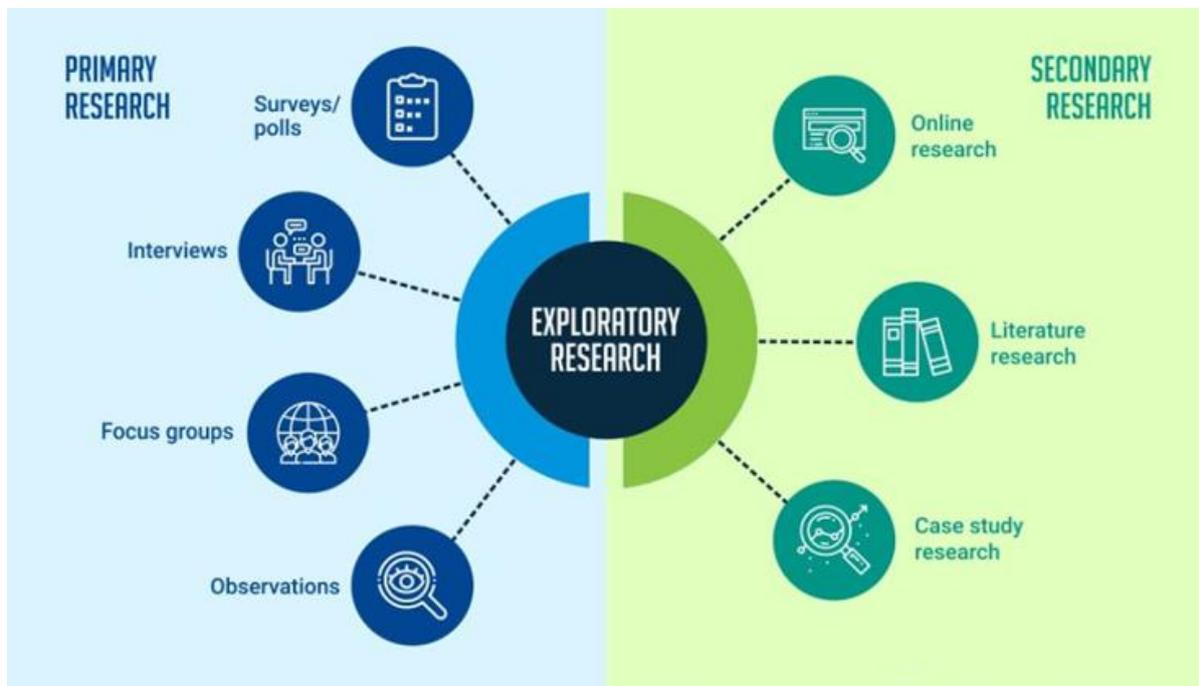
Figure 10 - Characteristic research methods of exploratory research (Bhat., n.d.).

For the primary research component, semi-structured interviews were selected to collect in-depth, qualitative data from municipal professionals directly involved in public space projects. Interviews were preferred over focus groups because the topics under discussion were sometimes context-specific and sensitive. A one-to-one setting ensured that participants could speak openly without peer influence or the risk of disclosing internal challenges in front of colleagues. The interview protocol is semi-structured to keep consistency across interviews while still allowing the flexibility to capture additional or unique insights.

For the secondary research component, a systematic literature review (SLR) was undertaken to map academic literature on circular economy principles, sustainable value creation, and public space development. The SLR was chosen over less structured literature searches to ensure methodological transparency, comprehensive coverage, and replicability of the review process. This review formed the theoretical foundation for the interview protocol and provided a comparative lens through which to interpret the empirical findings.

Additionally, the study employed a case study approach, with the Municipality of Rotterdam serving as the single embedded case. This approach enabled an in-depth examination of how circular economy principles and value considerations are applied in practice, combining both primary interview data and secondary document analysis.

3.3   Literature review methodology

This section consists out of two parts: the methodology of the data collection and the methodology of the data analysis.

3.3.1   Data collection of the Systematic Literature Review

To explore how value is interpreted in the context of circular public space, a systematic literature search was conducted in Scopus, one of the leading academic databases for peer-reviewed sources. This literature review followed a systematic search and screening process, inspired by PRISMA principles (Page et al., 2021), but adapted for the conceptual and qualitative focus of this thesis. The term of 'municipal outdoor public spaces' is not commonly used as a standard search term in academic literature. Therefore, broader terms were used to capture relevant studies. The search was applied to the *Title, Abstract, and Keywords* fields (TITLE-ABS-KEY), using combinations such as: "public space" AND "circular economy", "urban space" AND "sustainable value creation", and "outdoor space" AND "sustainable value". The search was limited to peer-reviewed journal articles, published in English, from the year 2015 onwards, to ensure contemporary relevance (see Table 4).

Table 4 - Search string and parameters used in Scopus system review (Own work, 2025).

Category	Details
Search string	TITLE-ABS-KEY(("public space" AND "circular economy") OR ("urban space" AND "sustainable value creation") OR ("circular economy" AND "sustainable value" AND "space") OR ("outdoor space" AND "sustainability value") OR ("municipal space" AND "sustainable value creation") OR ("outdoor space" AND "circularity"))
Database	Scopus
Search fields	Title, Abstract, Keywords
Publication range	January 2015 – April 2025
Language	English
Document type	Peer-reviewed journal articles

In total, a total six keyword combinations were used to identify relevant sources. As can be seen in table 5, the keyword combinations resulted in 483 results. After applying filters for the publication year and language, 328 sources remained for further review. These filtered sources were then subjected to a series of screening processes to ensure their relevance and alignment with the research objectives.

Table 5 - The six keyword combinations used in Scopus with the associated results (Own work, 2025).

#	Search String	Initial Hits (n)	Records after applying publication year and language filter (n)
1	"public space" AND "circular economy"	144	37
2	"urban space" AND " sustainable value creation"	144	114
3	"circular economy" AND "sustainable value" AND "space"	99	96
4	"outdoor space" AND "sustainability value "	75	63
5	"municipal space" AND "sustainable value creation"	11	10
6	"outdoor space" AND "circularity"	10	8
	Total:	**483**	**328**

After applying each search string and filtering by publication year and language, the resulting sources were exported to the reference management software Mendeley. Once all results were collected, duplicate entries were identified and removed using Mendeley's built-in duplicate detection function. This ensured that each study included in the next screening phase was unique and not counted multiple times across different keyword combinations. This step resulted in 249 academic sources saved in Mendeley.

To ensure that the literature used in this research is directly relevant to the concept of sustainable value creation, a structured screening process was applied to all 249 sources collected in Mendeley.

The first screening step consisted of reviewing the title of each source to determine whether it suggested a focus on sustainability, circular economy, or value-related outcomes. Titles were included if they referenced these concepts explicitly or implied an interest in how CE create or influence sustainable value. Sources that were clearly technical or unrelated to sustainable value were excluded at this stage. This initial step served to eliminate studies that were clearly outside the conceptual scope of this thesis.

The remaining sources underwent a second screening based on an abstract review to confirm whether the concept of sustainable value creation was discussed in sufficient depth. Through this iterative process, it became evident that while many of the sources retrieved from Scopus

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address circular economy and sustainable value creation, they do not specifically focus on municipal public spaces. A large number of sources discuss these concepts in more general or sector-specific contexts (e.g. construction, built environment, manufacturing), without linking them directly to the spatial or public space. These articles were removed after reading the abstracts.

In Table 6, the inclusion criteria for the categorisation are listed. This table provides a clear outline of the specific criteria used to classify the sources according to their relevance to sustainable value creation in the circular public space.

Table 6 - The inclusion criteria for categorising the included sources in this literature review (Own work, 2025).

Category	Inclusion criteria
Non-spatial sources	- The source focuses on general or sector-specific theories related to sustainability and circular economy. - Not specific to urban or public space
Public space	- The source is in a public space context - Relates to sustainability and circular economy in urban environments.

Before analysing the selected sources, a clear distinction was made between values and other related elements such as tools, strategies, or performance indicators. Only those aspects that reflected an underlying purpose or intended outcome of circular approaches were categorised as values. This ensured that the review remained focused on identifying the core meanings of sustainable value.

In figure 11, an overview of the methodology used in this literature review is presented.
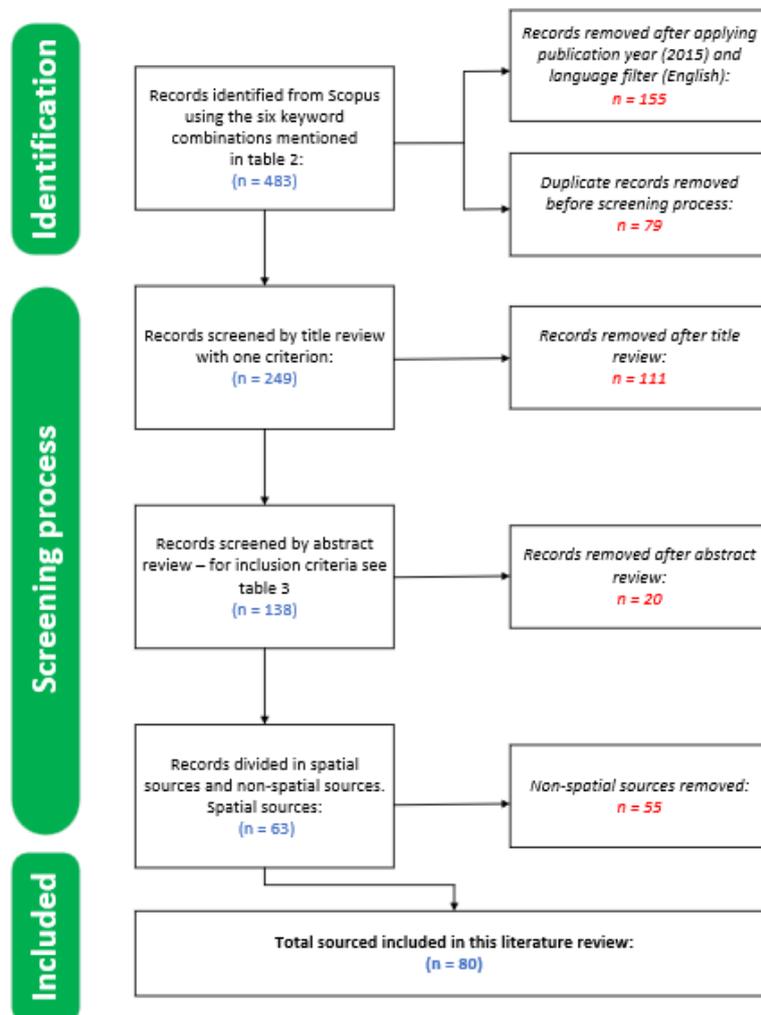
Figure 11 - Systematic literature review process based on PRISMA guidelines (Own work, 2025).

3.3.2 Data analysis of the Systematic Literature Review

When the data collection for the systematic literature review (SLR) was finished, the data analysis phase began. The objective of this phase was to systematically examine how the concept of *circular public space* is defined in the academic literature, which values are associated with it, and whether any value trade-offs are addressed in the literature. The process was structured and iterative in nature. This allows for flexibility to adapt as new insights emerged during the process.

The concept 'circular public space'

The first step in the analysis was to determine how the term *circular public space* is defined or used in existing academic discourse. To do so, a straightforward keyword search was

conducted by entering the phrase 'circular public space' directly into the full-text of the selected articles. The intent was to locate definitions of the term as it appears in academic writing. As the result of this analysis affected the data analysis of the next part (values in the circular public space), it is also mentioned in this subsection. The analysis revealed that the phrase *circular public space* is not used or defined in any of the reviewed sources.

This term is used because of three reasons. The first one, this term is already used in practice. The second reason is that this term brings two core concepts together in one clear label: Circular Economy and Public Space. Finally, it avoids unnecessary abstraction and provides a straightforward terminology that can be consistently applied throughout both the literature review and the empirical study.

Values in the public Space

To identify the values associated with the circular public space, a targeted keyword analysis was performed. As the term circular public space is not used in the literature, a more accurate description for the results is *values in the public space* without mentioning the adjective *circular*. Initially, the search focused on specific phrases such as 'environmental value', 'economic value', and 'social value'. However, this search approach yielded in limited results. It became apparent that such specific combinations of words were too narrow to capture findings on value within the literature.

As a consequence, the strategy was revised in an iterative manner. Instead of searching for exact phrases, the analysis was broadened by searching for the terms 'environmental', 'economic', and 'social'. This allowed the analysis to find more nuanced references to these three dimensions of sustainability, even if they were not explicitly labelled as 'values' in in the text. The reason why these searching terms were chosen is based on the theoretical background. The sustainable value creation in CE definitions were often framed in these three dimensions.
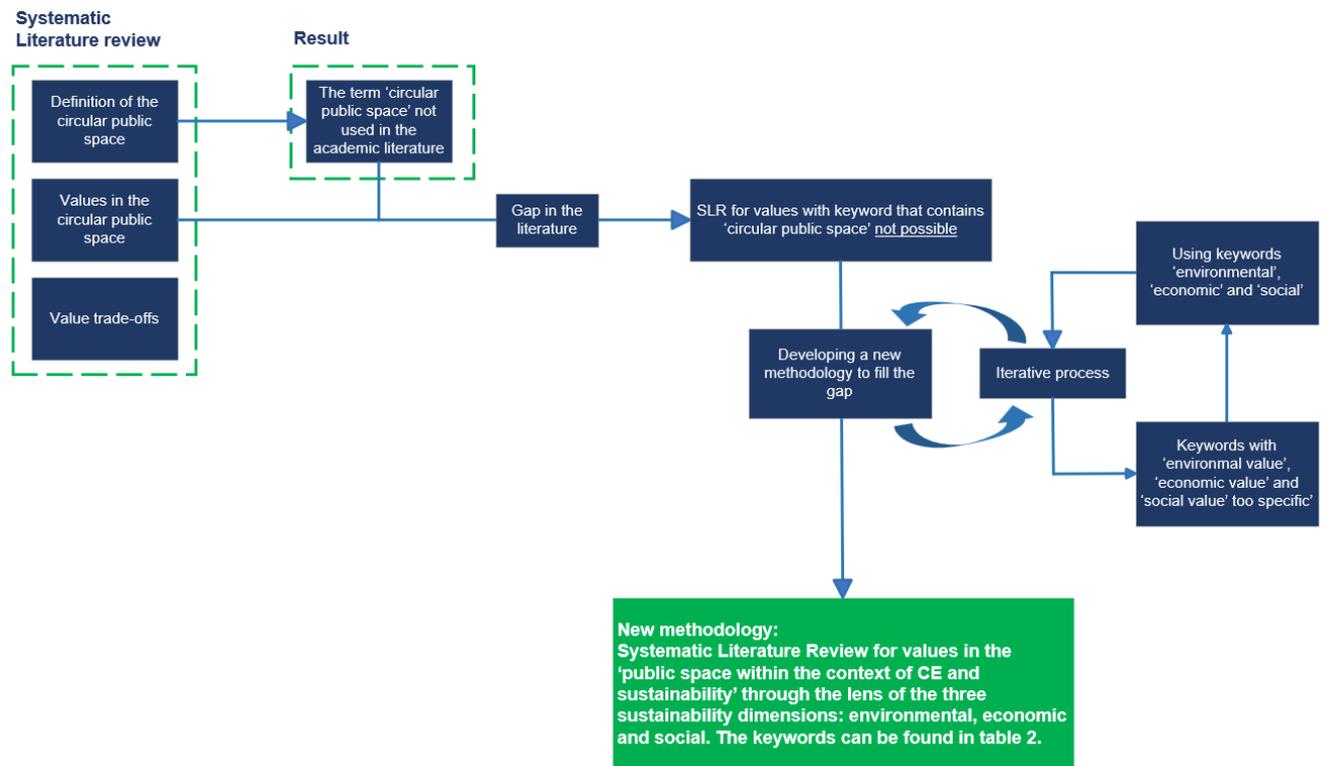
Figure 12 - Development of the methodology for identifying values in the public space (Own work, 2025).

The aim of this refined approach was to locate conceptual frameworks, tables, or structured descriptions in which the environmental, social, and economic dimensions are translated into values in the public space. These searches were conducted within academic articles that, while not necessarily referring to *circular public space*, did address CE or sustainability in the context of urban or public spaces. The final goal hereby was to investigate what these values / dimensions exactly mean in the circular public space. This process can be seen in Figure 12.

This analysis clarified that while the literature does not explicitly define *circular public space* as a term, it does provide insights into how values are interpreted in public space in CE contexts. The frameworks and tables found in several articles formed the empirical basis for the deductive coding structure used in the empirical part of this study.

Value trade-Offs

Finally, the literature was reviewed for any explicit reference to value trade-offs in the design, development, or management of public space. In this case, a qualitative scanning method was employed. The documents were read with particular attention to section headings and subheadings that might indicate discussions around conflicts, tensions, or trade-offs between values in the public space.

3.4 Empirical research methodology

The empirical research methodology consists out of 5 steps. These steps are all explained in the following subsections.

3.4.1 Step 1: Selection and invitation of the interview candidates

For selecting the interview candidates, a purposive sampling approach was adopted. Purposive sampling is a non-probability sampling method in which participants are deliberately selected based on predefined characteristics or criteria relevant to the research aims (Bullard, 2024). In contrast to random sampling methods, purposive sampling allows researchers to focus on those individuals who hold particular knowledge, experience, or professional roles that are critical to answering the research questions. The second method used to select the interview candidates is chain sampling (also known as snowball sampling). This is a non-probability sampling method where existing participants help recruit future participants (Nikolopoulou, 2022). In this study, chain sampling is used limited because the desired number of participants was reached

The selection of the interview candidates was guided by three criteria:

1. The candidate works at the Municipality of Rotterdam.
2. The candidate has a clear and active involvement with CE or sustainability in their work. This includes, but is not limited to, professionals working in roles as an advisor, designer, project manager, or transition director.
3. The candidate's expertise is the development, management, or transformation of the public space. Professionals whose work is limited to non-spatial domains like buildings were excluded from the selection to maintain a focused scope on the public space.

An initial list of potential interview candidates was provided by the external supervisor at the Municipality of Rotterdam. Each candidate was subsequently reviewed against the selection criteria described above. Candidates who did not meet all three criteria were excluded from the study. Those who satisfied the criteria were retained for the next phase of the selection process.

Before sending the first invitation for research participation, several preparatory steps were needed. First, approval was obtained from the Human Research Ethics Committee (HREC) at TU Delft. This included submitting the Informed Consent form (Appendix B), the Data

Management Plan (DMP), and the Human Research Ethics Checklist. These documents ensured that ethical standards regarding data protection, anonymity, and participant rights were clearly defined and safeguarded. Second, a decision was made regarding the desired number of interviews and the intended duration of each session. Third, although a full interview protocol was not required at this stage, a description of the research aim and context was formulated to be included in the interview invitation. This allowed potential participants to understand the purpose and relevance of their involvement in advance.

When these steps were done, the first round of interview invitations by email was sent to the selected candidates. Upon receiving confirmation of their willingness to participate, a second mail was sent to arrange a specific date, time, and location for the interview. The interviews were conducted in person. If the candidate was not able to attend in person, the interview took place online. This happened three out of ten times.

This whole process is illustrated in Figure 13.
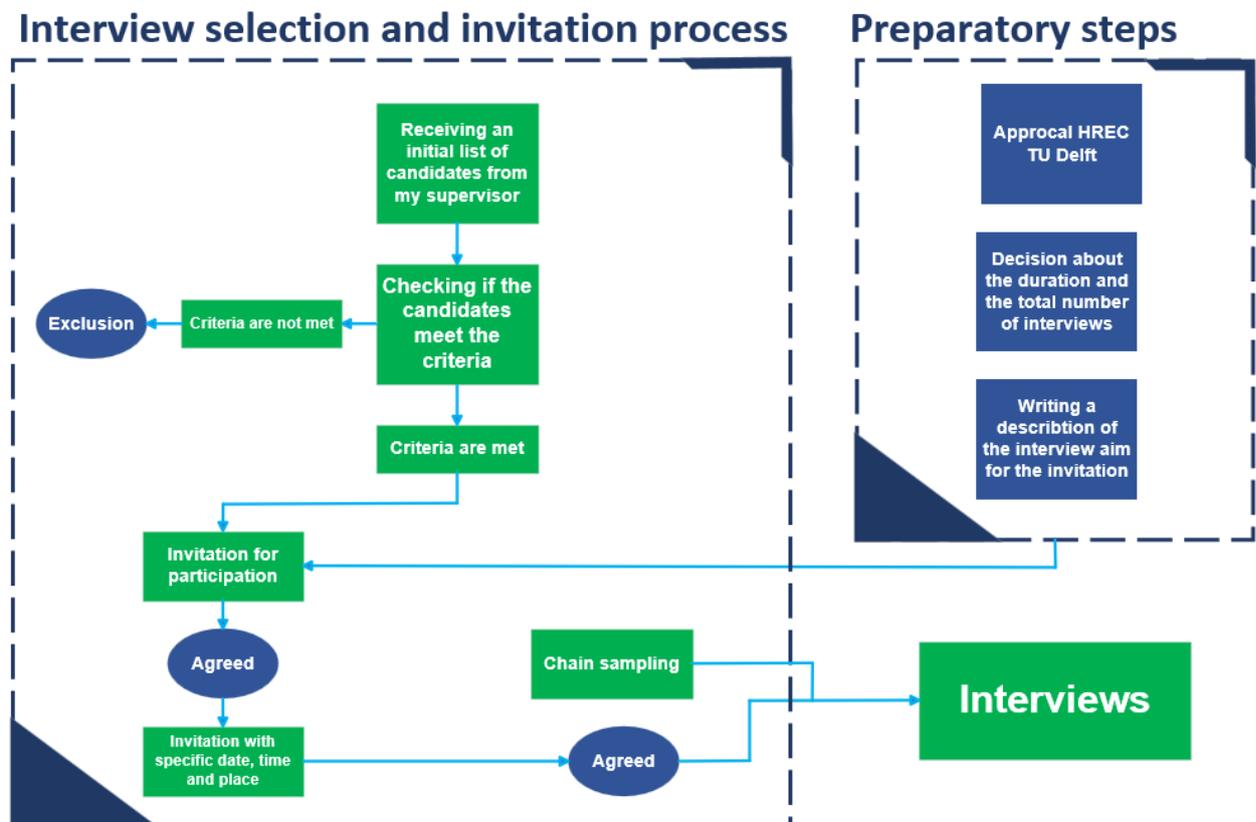
Figure 13 - Interview selection and invitation process (Own work, 2025).

3.4.2 Step 2: Development of the interview protocol

After the interviews were planned, the interview protocol was developed.
Developing an interview protocol was an iterative process, with questions frequently revised. This process is described in Figure 14. The protocol consists out of 5 parts and are described below.

1. Opening

The interview begins with a short introduction by the researcher. Participants are welcomed and briefly informed about the purpose of the study, the duration of the interview and their rights as participants. Before proceeding, verbal consent is obtained for audio recording and the Informed Consent is signed. The first question is always a request for the participant to introduce themselves and what exactly their position entails within the municipality.

2. Circular public space and value creation

This second part is a structured component of the interview. In contrary to the third and fourth part which are more exploratory in nature, this part focuses on three standardised questions posed to each participant. Participants are first asked to define the term 'circular public space' in their own words, followed by an open-ended reflection on what they consider to be of value within the circular public space. Finally, they are asked to confirm or refine a summary of the values they described.

By using the same set of questions across all interviews, this part of the protocol contributes directly to answering SRQ3: *How is the circular public space interpreted in practice, and what values are associated with it?*

3. Value trade-offs

The third part of the interview takes a more exploratory approach. It focuses on uncovering how professionals deal with tensions between values during the development of the circular public space. The interviewees were asked to reflect on real-world examples, decision-making dynamics, and the (in)formality of such trade-offs in practice. This part contributes to the first component of SRQ4: *How are trade-offs between different values made in the development of the circular public space, and what barriers influence this process?*

4. Barriers and opportunities

This section continues the exploratory approach by shifting attention to the barriers that influence the value trade-offs. Participants are asked to reflect on barriers they encounter, as well as opportunities that could improve value-based decision-making in circular public space projects. They are also asked about the relevance of a value trade-off system. This part addresses the second component of SRQ4 and serves as a foundation for SRQ5: *How can a value trade-off system be developed to support more structured and transparent value-based decision-making in the circular public space?*

    5.   Final question

Each interview was concluded with a final question to offer the interviewee space to add any relevant insights, experiences or opinions that were not covered in the interview.

The definitive interview protocol is in Dutch and can be found in Appendix C.
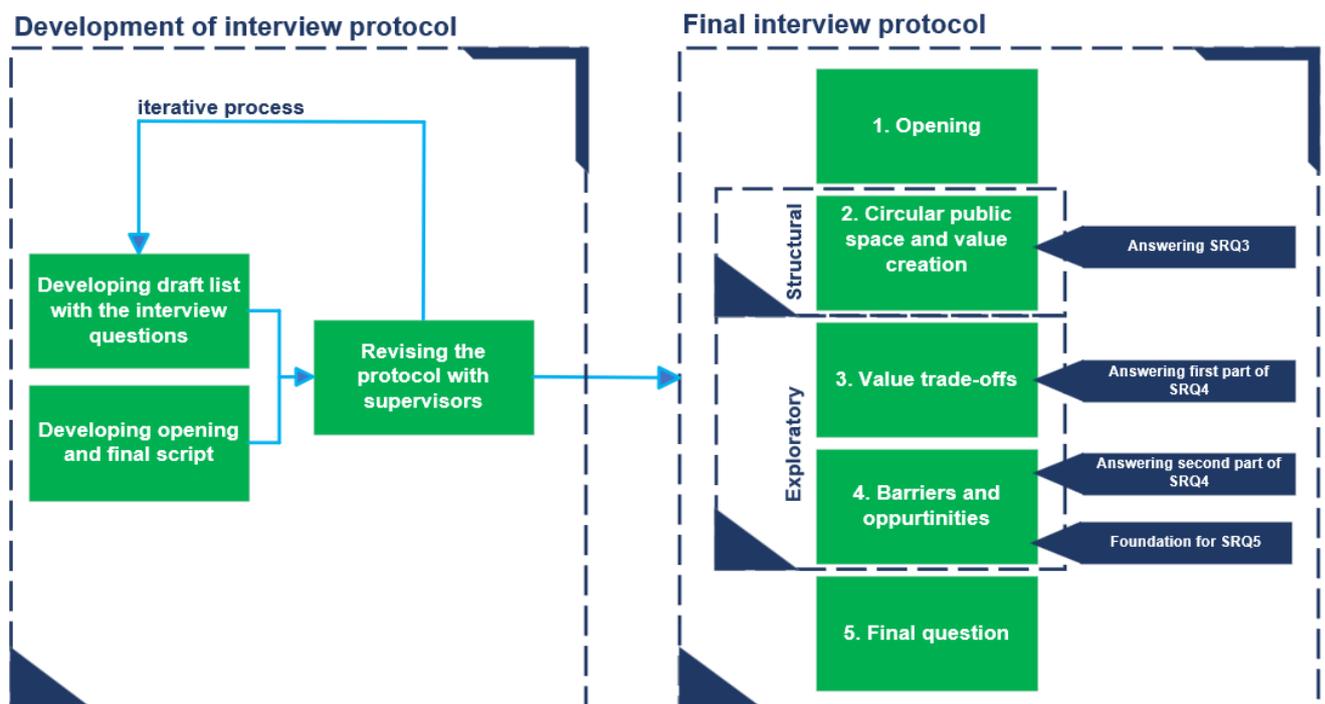
Figure 14 - Development of the interview protocol (Own work, 2025).

3.4.3 Step 3: Conduction of the interviews

After the interviews were planned and accepted by the invitees, and after the interview protocol was finalized, the interviews took place. A total of 10 people were interviewed. 8 people were approached through purposeful sampling, and 2 people through chain sampling.

All interviewees were willing to share their expertise in depth. The main language was Dutch and the average duration was 45 minutes. The interviews were audio recorded on two devices: a telephone and a laptop. This was done to prevent any recording errors. The interviews took place in the De Rotterdam building. Table 7 provides an overview of the professions of the interviewees. It also indicates the date and duration of each interview.

Table 7 - Overview of conducted interviews (Own work, 2025).

Code	Profession of the interviewee	Date of the interview	Duration of the interview in minutes	Relation to circularity
Adv1	Advisor	12 June 2025	35	Provides expertise on circularity; translates principles such as disassembly and reuse into policy and projects.
PM1	Project manager	12 June 2025	40	Civil project manager; responsible for technical feasibility, budget and delivery; determines how circular measures can be implemented.
PM2	Project manager	16 June 2025	40	Project manager in hydraulic engineering; focuses on reuse in water projects.
Adv2	Advisor and Transition Director Circularity	16 June 2025	60	Transition director for circular construction; initiates and drives CE projects, translates pilots into policy, ensures upscaling.
Des1	Designer	17 June 2025	40	Landscape designer; integrates circularity, aesthetics, and functionality into designs for public space.
Adv3	Advisor	17 June 2025	45	Advisor in asset management and circularity in the public space.
Adv4	Advisor	18 June 2025	40	Strategic advisor for public space; applies value-driven

				management, safeguarding social and ecological values, including circularity.
AM1	Area manager	19 June 2025	35	Area manager; translates circular ambitions into area projects, ensures coordination between stakeholders.
Adv5	Advisor	23 June 2025	45	Advisor in sustainability and procurement; responsible for embedding CE requirements in tenders and municipal programmes.
Adv6	Advisor	26 June 2025	40	Focuses on circular use of soil and organic residual streams to enhance biodiversity.

3.4.4 Step 4: Analysis of the interview output

After all the interviews were conducted, the analysis phase began. The method of analysis used in this study is thematic analysis. Thematic analysis is a foundational method for qualitative research, as it provides core skills for conducting many other forms of qualitative analysis (Nowell et al, 2017). It is defined as the method for identifying and analysing different patterns in the data (Aslam & Rana, 2022). The reason why specifically this analysis method was chosen for this study, is based on three grounds. First of all, this method offers theoretical flexibility which allows a range of disciplines to engage disciplinary theories and perspectives. Secondly, thematic analysis engages with analytic practices that are common with other approaches to qualitative analysis. Finally, this method is applicable with various data sets, as well as data set sizes (Lester et al, 2020).

Data collection and analysis are often non-linear and iterative in a qualitative research, as the processed of collecting, analysing and writing happen simultaneously in practice. This makes it difficult to work in steps or phases (Nowell et al, 2017; Lester et al., 2020). However, it can be useful to organise it into discrete but overlapping steps. By doing this, a transparent process it created for the researcher and the reader of a research report. These steps are shortly described below.

First of all, all audio-recorded interviews were gathered, named by interviewee and date of the interview, and stored in a central OneDrive folder. Written notes from the interviews were

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also digitised and added to the dataset. The second step was transcription of each recording in Microsoft Word. Any mentioned names in the interview were removed. The third step focused on becoming familiar with the data. Transcripts were read multiple times, and initial annotations were made to capture first impressions, interesting patterns, or potential connections to the research questions. Fourthly, the transcripts were imported into Atlas.ti for formal coding. Atlas.ti is a computer-assisted qualitative data analysis software that facilitates analysis of qualitative data. It is a tool that supports locating, coding, and annotating features within bodies of unstructured data. The software is used by researchers in a wide variety of fields, and it supports data in text, graphical, audio, video, and geospatial format (University of Johannesburg Library, n.d.). The coding methods used in this study are explained in the next sub-section. Fifthly, these themes were carefully linked to the study's sub-research questions. Each theme was evaluated for its relevance to the specific SRQ, and overlapping areas were noted and interpreted accordingly. Finally, everything is documented and prepared for reporting to ensure transparency in the data analysis phase. An overview of these steps can be seen in Figure 15.

1 Preparing and organising the data for analysis
- *Gathering the audio-recorded interview files into one OneDrive location.*
- *Naming each file to the interviewee and the date of the interview.*
- *Digitising written documents with notes in Micrsoft Word.*

2 Transcribtion of the data
- *Transcribing all audio-recorded interviews using Microsoft Word transcribing function.*
- *Removing any identifying information to ensure anonymity.*
- *Saving transcripts in a structured folder system using consistent file naming.*

3 Becoming familiar with the data
- *Reading thtrough all transcripts to gain an initial understanding of the data.*
- *Taking notes on first impressions, important concepts, or surprising remarks.*

4 Coding the data
- *Using Atlas.ti to conduct both first-cycle and second-cycle coding (explained in step …)*
- *Using an abductive approach (combination of inductive and deductive method)*

5 Linking the findings with the research questions
- *Reviewed all identified themes in relation to the study's main and sub-research questions.*
- *Grouped thematic findings under the sub-research question (SRQ) they best addressed.*

6 Making the analytical process transparent
- *Documenting how codes were merged or renamed throughout the process.*
- *Preparing visual overviews of codes, categories, and themes .*

Figure 15 - The steps undertook in analysing the empirical data - Inspired by: Nowell et al. (2017) and Lester et al. (2020) - (Own work, 2025).

3.4.5 Step 5: Coding methodologies

Coding in qualitative research can be defined as processes that enable collected data to be assembled, categorized, and thematically sorted, providing an organised platform for the construction of meaning (Williams & Moser, 2019). Coding is often divided into two stages:

First cycle and Second cycle. First cycle coding methods are codes assigned to the data segments or data units. Second cycle coding methods in general work with the resulting First cycle codes themselves (Saldaña, 2021).

For the First cycle, two methods were used: Structural coding and Descriptive coding. Both methods were applied in combination with an abductive approach (also known as 'hybrid approach'). The inductive approach involves developing codes based on the data itself. In practical terms, this means that the researcher will start the coding process with no preconceived codes or categories. In contrast to inductive coding, the deductive approach uses an existing theory or theoretical framework as a basis for a pre-defined set of codes. As both methods were used, the overall coding methodology for this study is the abductive approach (Jansen, 2024).

First cycle coding methods

First cycle coding methods include more than 25 different approaches (Saldaña, 2021). The first method used is *structural coding*. This method can be defined as a way to organise the data around the specific questions which have to be answered. Rather than looking for what the respondents mean, the focus is on how different sections of the data relate directly to the research questions (Delve & Limpaecher, 2024). The second coding used in the First cycle is *descriptive coding*. A descriptive code assigns labels to data that summarise in a word or a short phrase the basic topic of a passage in a qualitative data (Saldaña, 2021).

In this research, structural coding was applied to data segments that directly corresponded to the standardised questions in the interview protocol, particular those concerning the *definition of the circular public space* and the *values in the circular public space*. The first of these was coded inductively, as the concept of circular public space is not explicitly defined in the literature and the aim was to capture participants' own interpretations. The second was coded abductively, as the three sustainability dimensions and the values were found in the systematic literature review. This is the deductive part, while additional emerged values were coded inductively.

In contrast, descriptive coding was applied to the exploratory sections of the interviews, where participants reflected on examples and broader experiences. This included discussions of *value trade-offs* and the *broader systemic challenges* that affect the implementation of circularity in the public space. Both of these were coded inductively, as the categories emerged from the data rather than from a predetermined framework from the literature.

Second cycle coding methods

Following the first cycle, a second cycle of coding was undertaken using *pattern coding*. This process involved clustering related structural and descriptive codes into broader, more abstract themes that could explain larger patterns in the data (Saldaña, 2021). For example, after the values in the public space were identified, the values were during the second cycle categorised in the three dimensions of Elkington (1997).

An overview of the coding methodologies used in this study can be seen in Figure 16.

First cycle coding	Structural coding	Defining the circular public space	Inductive	RSQ3
		Values in the circular public space	Abductive (deductive+inductive)	RSQ3
	Descriptive coding	Value trade-offs and barriers in the circular public space	Inductive	RSQ4
		Broader organisational findings	Inductive	RSQ4 RSQ5
Second cycle coding	Pattern coding	Grouping related first-cycle codes into broader themes that explain larger patterns in the data and directly address the research questions.	Abductive (deductive+inductive)	All SRQ Discussion Conclusion

Figure 16 - Overview of coding methods, approaches, and their link to the research questions (Own work, 2025).

In Appendix D, an example can be seen of how the two cycle coding methods were used to extract a value from a quote of a correspondent.

3.5   Development of the Value Trade-off System

The development of the Value Trade-off System (VTS) was included as a separate step in the research design. First, the systematic literature review was carried out to collect input on sustainability dimensions and value considerations in the circular public space. Second, semi-structured interviews were conducted to add practice-based perspectives from municipal professionals as explained in the previous sections. Third, principles were extracted from the analysed data, which are presented in Section 5.2. Based on these principles, the VTS was then designed as a conceptual framework. The detailed description of this framework is given in Sections 5.2 and 5.3, while its further validation and application are left for future research.

4. Results

4.1   Introduction to the Results

This chapter presents the results of the empirical research. The empirical part consists of 10 semi-structured interviews with municipal professionals involved in the management of public space projects.

When structuring the sections of this chapter, it was decided not to follow the order of the interview protocol explained in section 3.4.2. Rather, the chapter begins with the organisational findings in section 4.2, since these findings provide essential context for understanding how circular ambitions gradually fade across project phases. Only after explaining these structural challenges, the chapter moves on to the definition of the circular public space (section 4.3), the values that professionals associate with it (section 4.4), and the way value trade-offs are managed in practice (section 4.5).

4.2   Organisation challenges leading to the decline of circular ambitions

The interviews revealed that organisational factors play a decisive role in whether circular ambitions survive the full course of a project. While circularity is often introduced with enthusiasm during the early stages, its visibility and influence tend to decline as projects move through design, procurement, execution, and evaluation. This decline is not the result of a single barrier, but of a sequence of structural and organisational gaps that weaken commitment at each phase.

The following subsections trace this decline, starting with the strong ambitions that characterise the initial stages but which lack binding power in project requirements. They then examine how partial translation and the absence of measurable targets limit circularity during design and procurement, how technical constraints and person-dependence affect implementation during execution, and how the lack of evaluation and organisational learning prevents improvement over time. The section concludes with an overview of these challenges and a visual summary of how they contribute to the gradual fading of circularity through project phases.

4.2.1 Strong ambitions but lack of formal requirements

Across interviews, respondents consistently described circularity in public space projects as beginning with strong ambitions at the policy or initial phase. These ambitions are often articulated in vision documents, early project briefs, or kick-off presentations, sometimes framed in aspirational terms such as '*making the public space fully circular by 2030*'. However, interviewees stressed that such ambitions rarely translate into binding project requirements.

One designer noted that the municipality is '*excellent at formulating visions and ambitions, but giving them hands and feet is where it goes wrong*'. In practice, there is often no clear process for assessing whether a circularity target is feasible, nor a concrete plan for achieving it. As one interviewee explained: '*We set 50% circular by 2030 as a goal, but no one checked if it was realistic. There's no system for measuring it and no breakdown of what has to change to get there*' [Des1].

The absence of formal requirements in key steering documents, particularly the programma van eisen (PvE), was multiple times identified as a turning point where ambitions begin to lose force. If circularity is not clearly described in the PvE, later phases default to established practices. As one interviewee stated: '*If it's not in the PvE, there's nothing to steer on - designers and contractors can simply ignore it*' [Adv3].

This lack of formalisation is compounded by vague definitions and the absence of measurable targets. Without agreed metrics or methods for calculating circularity, it is difficult to compare options or defend circular solutions when other priorities, such as budget control or delivery speed, come under pressure.

Because of this, circularity often stays at the level of a broad ambition. It sets a general direction, but it is not a structured part in the documents and decisions that guide the project. When the work moves into detailed design and realisation, other priorities usually take over, and the original circular goals quietly slip into the background.

4.2.2 Weak translation and absence of measurable targets

Even when circular ambitions are mentioned in early project stages, they are often only partially translated into concrete design and procurement requirements. Several respondents pointed out that the wording in project briefs or tender documents tends to stay vague. Phrases are used like '*apply circular principles where possible*' [Adv2] or '*reuse materials where*

feasible' [Adv2], without explaining what this means in practice. This leaves designers, engineers, and contractors to interpret the goal themselves, often leading to inconsistent results.

An advisor explained: '*We might write in the brief that the bridge must be circular, but we don't say what that means. Is it about reused materials? Design for disassembly? Lower CO_2 emissions? Without that clarity, it's impossible to monitor later'* [Adv4].

The lack of measurable targets was also seen as a barrier. Without clear requirements such as specifying a percentage of reused materials, a quantified CO_2 emission reduction, or a MKP calculation of the environment impact, circularity cannot be compared fairly with other project goals. One project leader described the consequence: '*You can say you want circularity, but when you have to choose between two options, you can't really weigh it. Cost and time are easy to measure — circularity isn't'* [PM1].

This absence of clear requirements makes it difficult to defend circular choices when they compete with short-term pressures. Respondents said that when budgets tighten or deadlines loom, goals that are harder to quantify tend to be the first to go. As one interviewee summarised: '*If you can't show the numbers, it's always the circular parts that get cut'* [PM2].

4.2.3 Execution barriers and person-dependence

During the execution phase, respondents described how practical constraints often overtake earlier circular ambitions. Tight schedules, budget limits, and technical uncertainties can make circular measures seem risky or inconvenient. This is also illustrated by a quote of an Area Manager of the municipality of Rotterdam: '*In later phases, the focus shifts to deliverability and cost control. Reused materials or alternative suppliers can be seen as a risk, so they're often the first to be dropped'* [AM1].

Several interviewees gave examples of how logistical issues undermine circular intentions. A common challenge is timing: materials from one project may not be available when another needs them. This leads to extra handling, storage, and transport, which can cancel out environmental benefits. As one respondent noted: '*Ideally you take it out here and place it there, done. But often you have to store it, move it a few times, and by then the gain is gone'* [PM2].

Another barrier comes from person-dependence. Multiple respondents emphasised that the success of circular actions often relies on individual motivation and expertise. One advisor was very clear about this, as she stated: '*It really depends on whether someone is passionate about it. If not, it slips through the cracks*' [Adv1]. Without team members who actively push for it, circularity is less likely to survive the compromises made during execution.

Fragmentation between teams also plays a role. Project phases are often handled by different departments or contractors, and the original circular vision can be lost in handovers. As a project manager recalled: '*Circularity was a big thing in the concept phase, but it never came up again once we handed over to engineering and procurement*' [Adv3].

So in the execution phase of public space projects, the realisation of circular ambitions is influenced by time pressure, financial constraints, and the extent of commitment of the team members.

4.2.4 Absence of evaluation and organisational learning

Finally, interviewees explained that there are currently no structured moments to evaluate circular outcomes once a project is completed. When evaluations do take place, they are generally limited to checking whether the work was delivered on time, within budget, and according to the safety and quality requirements. Circularity is not a part in this process. As one respondent said: '*We don't have a moment where we ask: what did we actually learn from this? Did the circular goals happen? What dilemmas came up?*' [Adv2].

This lack of systematic evaluation was highlighted by several interviewees who stressed that lessons from circular pilots are rarely documented or shared. As a result, project teams often have to 'reinvent the wheel' instead of building on earlier experiences. One transition director explained: '*Even if something worked really well in another project, there's no mechanism to pass that knowledge on. The next team starts from scratch.* [Adv2]. Similarly, other respondents noted that ambitions are not structurally embedded or evaluated, which means circular goals can quietly fade without accountability [Adv4, AM1].

Respondents also pointed to the absence of practical tools that could make circular principles easier to implement in the public space projects. Examples of these tools are internal handbooks, design templates, decision trees, or value trade-off systems. Without these, circularity often depends on personal experience rather than organisational systems.

The result is that knowledge remains fragmented and heavily tied to individuals. When those individuals leave or move to another role, their experience leaves with them. This weakens the municipality's overall capacity to implement circularity in a consistent and scalable way.

4.2.5 Overview

The findings from the interviews explained in the previous sections show that circular ambitions decline gradually as projects move through their phases. Figure 17 provides an overview of this process.
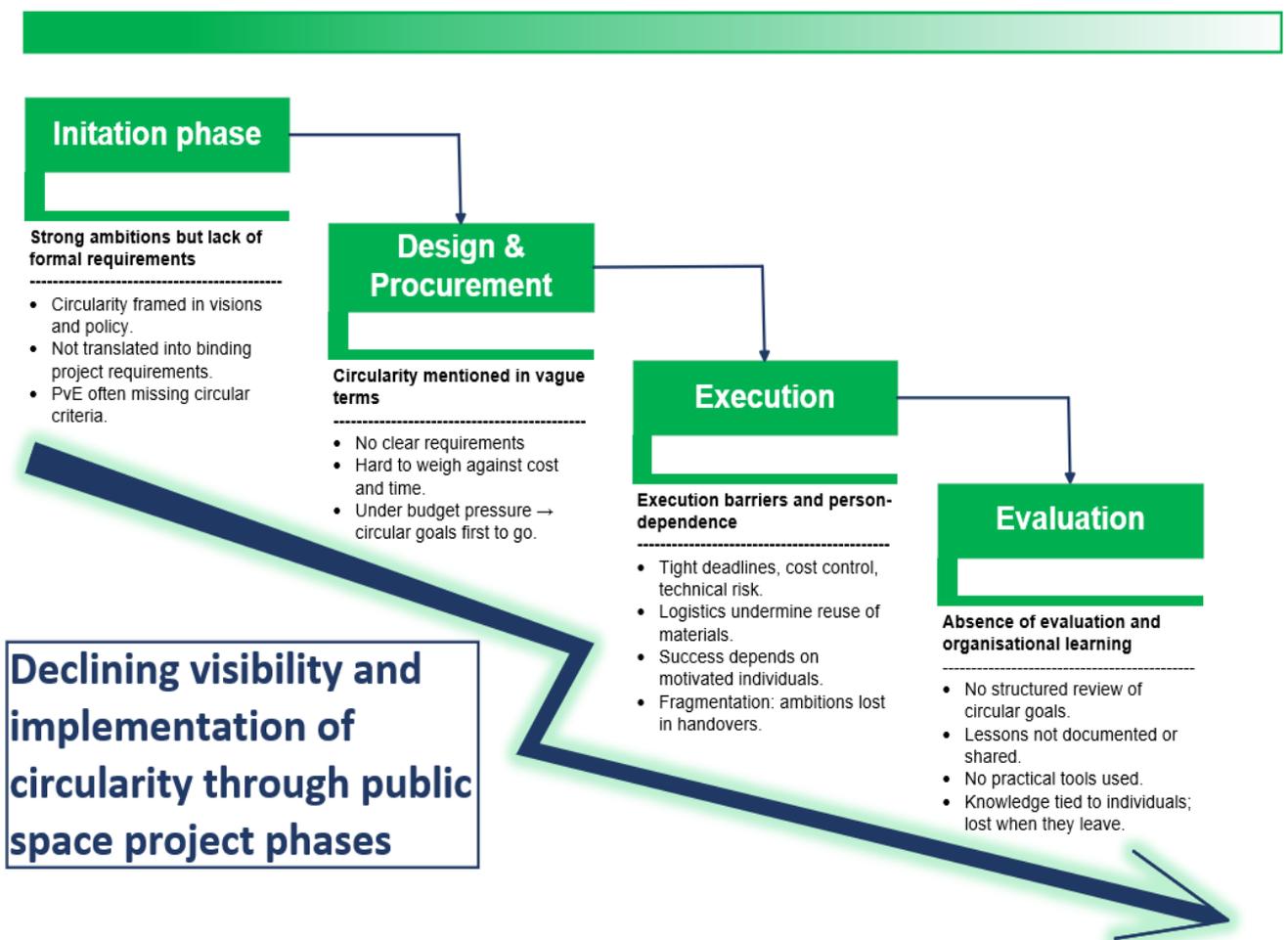
Figure 17 - Declining visibility and implementation of circularity through public space project phases. Constructed from semi-structured interview findings (Own work, 2025).

4.3   The definition of the circular public space

This section explores how municipal professionals understand the concept of the circular public space. In section 4.3.1, the recognition of the concept is discussed. In the following section, the thematic interpretations that emerged from the interviews are presented.

4.3.1   Recognition of the concept

All respondents were able to describe what they understood by the term circular public space. This shows that the concept is not unknown to the municipal professionals.

At the same time, the responses revealed that the concept does not have a fixed or widely shared definition. Most interviewees hesitated before answering or started searching for the right words by thinking out loud. Their definitions were often exploratory and personal, pointing to the absence of a known definition in the organisation. As one advisor noted: '*I know what we do that could be called circular, but whether that is the same as the official definition, I'm not sure*' [Adv1].

Some participants kept their answers very practical, linking circular public space directly to specific actions. One project manager described: '*For me it's straightforward - if you can reuse it, then it's circular*' [PM1]. Others, connected the concept to broader ideas of sustainability or long-term value creation. This variation reflects that the term is recognised, but not uniformly interpreted.

Overall, the findings suggest that circular public space is known as a concept, but its meaning is still fluid and open to interpretation. The lack of a common definition in the organisation means that professionals rely on their own intuition and experience when asked to explain it. This recognition without standardisation forms the basis for the thematic patterns described in the next subsection.

4.3.2   Thematic interpretations

The analysis of the interviews shows that respondents associated the circular public space with a range of themes, which were derived through inductive coding. These themes, together with the descriptions from the interview and the number of respondents who mentioned them, are presented in Table 8. The results confirm that the concept is recognised in practice, but interpreted in diverse ways.

Table 8 – Themes which describe the circular public space according to the interviewees (Own work, 2025).

Themes	Description (based on responses of the interviewees)	Number of respondents that mentioned the theme in their answer
Reuse of materials	Reapplying existing elements in the public space such as paving stones, lighting columns, or benches.	10
Closing the lifecycle	Keeping materials in a continuous loop of reuse or recycling.	5
Reducing waste	Minimising disposal and preventing resources from being lost.	4
Extending the lifespan	Designing and maintaining assets to remain functional longer.	3
Wellbeing of the people	Creating spaces where people feel comfortable and at ease.	2
Aesthetics	Ensuring design quality and visual appeal in the public space.	1

The most prominent theme, mentioned by all ten respondents, was the reuse of materials. The circular public space was strongly associated with reusing elements such as paving stones, , benches, or other components from previous projects. Respondents viewed this as the most practical way to make the public space more circular.

Half of the respondents described circular public space in terms of closing the lifecycle of materials. This theme emphasised the idea of a continuous loop in which resources remain in circulation in stead of being discarded. Four respondents connected the circular public space with reducing waste streams. This means not only to minimising the disposal of materials, but also to change habits in the execution phase of public space projects, so that fewer resources are lost along the way. One interviewee stated: *'we have made it too easy to throw things away or burn them'* [Adv6].

Three respondents mentioned the concept of 'extending the lifespan'. This included designing and maintaining materials and structures so that they remain functional for longer periods. Another theme mentioned by three respondents was the link between circularity and the wellbeing of the people. In these accounts, circular public space was also described as

creating environments where people feel comfortable and at ease. As one participant put it: *'It's also about people feeling good in the space'* [Adv6]. Finally, one respondent associated circularity with aesthetics and design quality. This theme implies that a circular public space should also be visually appealing and pleasant to experience.

4.4 Value creation in the circular public space

After the question was asked what the definition is of the circular public space, the second question was about the values in the circular public space. Values was explained in the interview as aspects that are considered important ('Ergens belang aan hechten' in Dutch) when designing or realising the circular public space. On that basis, participants were invited to reflect on what they consider important in their professional context. Although the question was intentionally open, it proved to be challenging for all respondents. None provided a structured or clearly formulated list of priorities. Instead, their responses emerged gradually by using examples, associations, and case-specific reflections. To ensure the accuracy of interpretation, each respondent's input was summarised during the interview. This was done by listing the terms they had mentioned as important. The summary was explicitly confirmed or corrected by the interviewee before continuing.

4.4.1 First cycle

In this section, the values which play a role in the circular public space are presented. Not all of the values are self-explanatory. Therefore, some of them are further clarified using the explanations and examples provided by the respondents during the interviews. The values in the circular public space are presented in Table 9.

Table 9 - Values in the circular public space mentioned by the interviewees (Own work, 2025).

Value	Description (based on responses of the interviewees) if the meaning of the value is not obvious	Number of respondents that mentioned the value in their answer
Climate regulation	This value is linked to reducing CO_2 emissions and contributing to climate adaptation measures.	2

Material quality	Durability and technical performance of materials	3
Pollution reduction	The reduction of pollution.	1
Economic vitality	This value consists out of: Job opportunities and local business development.	5
Functionality	The extent to which the design of public space enables it to serve its intended purpose effectively and efficiently.	1
Safety	The degree to which public space provides a secure and protected environment for its users.	2
Social well-being	The value refers to the well-being of the residents and the users of the public space.	3
Public participation	This value is about involving residents and stakeholders in decisions and activities in the public space.	4
Social inclusivity	The core of this value is that the circular public space is accessible and welcoming to all groups of people.	3
Aesthetics	This value is about the visual appearance of the public space.	4
Biodiversity	Biodiversity is protecting and improving the ecology in the circular public space, such as green spaces that support varied plant and animal life .	1
Resource efficiency	This value contains the following: using materials efficiently, reusing what is available, and reducing primary raw materials .	6
Accessibility	This value is about keeping the public space available and accessible for everyone.	2

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4.4.2 Second cycle

In the second coding cycle, the values identified in the interviews were grouped into the three dimensions: environmental, economic, and social. Some values can be positioned in multiple dimensions.

Table 10 - Values in the circular public space categorised into the three dimensions of sustainability (Own work, 2025).

Dimension:	Environmental dimension	Economic dimension	Social dimension
	Climate regulation	Economic vitality	Social well-being
	Pollution reduction	Resource Efficiency	Public participation
	Biodiversity	Material quality	Social inclusivity
	Recourse efficiency		Safety
			Aesthetics
			Functionality
			Accessibility
Total number of mentions:	10	16	19

4.5 Value trade-offs

The question about value trade-offs was actually the first question in the exploratory part. Respondents unanimously acknowledged that trade-offs arise when applying circular principles in public space. While these tensions vary in nature, one common thread was the way circularity is understood in practice. For all respondents, circularity was primarily associated with the reuse of materials. As a result, discussions about trade-offs centred less on circularity as a broad value system, and more on how material reuse competes with other ambitions in public space projects.

In section 4.5.1, the trade-offs mentioned by the interviewees are presented. Section 4.5.2 then describes how the municipality manages these trade-offs and how this process is

experienced by practitioners. Finally, section 4.5.3 displays an overview of the mentioned constraints which influence this process of weighing values against each other.

4.5.1 The trade-offs

The intention was to ask about trade-offs between the mentioned values in the circular public space (which were explained in the question before), but it became clear that some professionals primarily reflected on trade-offs between a value and a constraint such as budget or planning. Instead of weighing one value against another, respondents often described situations where values in the circular public space were set aside when constraints came into play. This indicates that in current practice, trade-offs are less about prioritising between values themselves and more about the tension between values and project constraints. To capture everything, both trade-offs are presented in Table 11. Each trade-off is explained and strengthened by a quote of the interviewee which illustrates the trade-off.

Table 11 - Trade-offs mentioned during the interviews (Own work, 2025).

Trade-off	Description of the trade-off	Example quote used in the interview
Circularity and Aesthetics	Reused materials often do not meet visual or design expectations, especially in high-profile public areas.	*'In a central square, reused paving was rejected due to poor appearance despite meeting functional requirements.'* [Des1]
Circularity and Functionality	Reused elements can reduce accessibility or practical performance.	*'Reused paving on the Coolsingel looked good initially but was slippery and uneven for wheelchair users.'* [Des1]
Circularity and Timing/Logistics	Circular ambitions fail when reused materials cannot be matched to project timelines.	*'Stones from one site could not be reused in another due to storage and timing issues.'* [PM1]
Circularity and Cost	Reusing materials can sometimes be more expensive than using new ones due to processing or transport.	*'Breaking concrete to exact sizes cost more than buying new materials'.* [PM2]
Circularity and Climate regulation	Circular actions like material reuse may involve emissions through	*'Reused stones were transported and processed several times, cancelling out*

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	multiple transport or inefficient processes.	*environmental benefits.'* [Adv1]
Circularity and Climate regulation	Circular choices may not support goals like water permeability or heat resistance.	*'Reused paving stones lacked water infiltration capacity, clashing with climate adaptation goals.'* [AM1]
Circularity and Biodiversity	Material or lighting choices for circularity can conflict with ecological goals.	*'LED lights added for energy savings interfered with the behaviour of nocturnal wildlife in parks.'* [Adv4]
Circularity and Safety	Circular design decisions can reduce perceived or actual safety.	*'Lighting adapted for biodiversity made parks feel too dark for safe use at night.'* [Adv4]
Circularity and Social well-being	Citizens or stakeholders may reject reused or 'less aesthetic' options, even when they are functionally fine.	*'Material reuse was criticised by users who associated visible wear with poor quality or neglect.'* [AM1]

4.5.2 How are the trade-offs managed

When asked how the trade-offs mentioned in Table 10 are managed in practice, respondents referred to the absence of a clear or formal process. How this process is described is closely related to the organisational challenges described earlier in section 4.2, where circular ambitions often fade during the course of the project. The way trade-offs are managed seems to follow the same pattern. Decisions are not guided by an agreed framework or set of criteria, but are made in an ad hoc manner. They are also heavily dependent on the circumstances of the project and the individuals involved. Due to this, decisions are not traceable and it is difficult to understand why other values are prioritised over circularity.

4.5.3 Constraints which influence the trade-offs

Finally, during describing the process of managing the trade-offs between values, several constraints were mentioned which influence this process. These constraints are not a value, but are often weighed against values as was demonstrated in Table 11. The constraints and its explanations can be seen in Table 12.

Table 12 – Constraints influencing the value trade-offs (Own work, 2025).

Constraint mentioned in the interviews	Explanation of the constraint based on the answers in the interview
Planning	Circularity often fades under strict project schedule. If for instance the reuse of materials takes too much time, it is abandoned.
Budget	Circular strategies involves usually more transport, extra processing and storage. This cost more than the normal way.
Logistics	The lack of storage and the coordination between the projects make using reused materials more difficult.
Feasibility	Reused materials are often seen as technically uncertain or risky, especially in later phases.

5. Value Trade-off System

This chapter presents the Value Trade-off System (VTS). In section 5.1, the relevance of the VTS is proved and explained. In the following section (5.2), the principles of the VTS which are extracted from the findings are described. In Section 5.3, the VTS is presented and structured around the 4 project phases. The reason the VTS is designed is to address three findings from this study are: (i) circular ambitions weaken as projects move through the phases, (ii) circularity is phrased mainly as material reuse without a lot of attention for other values, and (iii) there is no explicit or transparent way of weighing values against each other.

5.1   The need and goals of the VTS

As explained in Chapter 4, participants explained during the interviews that the weighing of values in public space projects is often neither clear nor structured. Decisions are currently made in a project- and person-dependent manner. Several respondents described the process as largely implicit, with choices being made ad-hoc instead of following a transparent or standardised procedure. When asked whether a practical tool to guide value trade-offs could improve this process, a question which was asked at the end of each interview, all interviewees responded positively.

Interviewees recognised that developing a comprehensive and fully integrated system for the entire municipality would require a long-term effort, possibly taking several years to embed within such a large organisation. This ambition goes beyond the scope of this research. The Value Trade-off System (VTS) proposed here should therefore be understood as a conceptual framework rather than a finished tool. It is not intended as a municipality-wide framework, nor is it expected that the VTS can be directly implemented in practice in its current form. Instead, it provides a practical starting point that encourages reflection, stimulates discussion, and gradually moves towards more structured and transparent value-based decision-making in public space. The aim of the VTS is not to prescribe outcomes or to audit projects after the fact, but to offer a structured procedure for making values explicit, translating them into goals and requirements, and documenting the trade-offs that arise across project phases. In this way, the model supports explicit and transparent choice-making, helping decision-makers to balance competing values while ensuring that the reasoning behind choices remains traceable and reusable in future projects.

5.2 Principles of the VTS

The literature review and empirical research together revealed findings. These insights were translated into the following principles, which form the foundation of the VTS:

- Address sustainable value creation as a core aim

The literature review showed that sustainable value creation is a central aim of the circular economy. This principle means that projects should explicitly seek to create sustainable value. It is anchored in the VTS by taking values as the starting input for every project.

- Include all three sustainability dimensions

Both literature and empirical findings identified values along the environmental, economic, and social dimensions. This principle ensures that trade-offs remain comprehensive and avoid overemphasis on a single dimension. It is embedded in the VTS through the broad set of values in the input list and their recording in the Ambition Note.

- Broaden circularity beyond material reuse

Empirical research showed that circularity in practice is often reduced to the reuse of materials. This principle highlights the need to connect circularity more explicitly to sustainable value creation. It is reflected in the VTS through the wide variety of values and goals that extend beyond material reuse.

- Make trade-offs explicit and transparent

The empirical study revealed that trade-offs are often managed in an implicit, ad hoc, and person-dependent way. This principle requires that trade-offs are surfaced, discussed, and documented in a structured manner. It is operationalised in the VTS through the Trade-off Ledger in the Execution phase.

- Safeguard ambitions throughout project phases

The empirical research showed that circular ambitions are often strong in the initiation phase, but fade during the next project phases. This fading was linked to several factors like constraints taking over, and the absence of a clear translation into project requirements. This principle emphasises the need to secure ambitions across all phases of the project. In the VTS, this is achieved by recording them in the Ambition Note, translating them into measurable

requirements in the Design & Procurement phase, monitoring them during Execution phase, and checking them against outcomes in the Evaluation Note.

- Support structured prioritisation of values

The empirical research showed that conflicting values are common, but that they are managed in an informal and person-dependent manner. The consequence is that prioritisation is unstructured. This principle calls for systematic prioritisation and justification of values when conflicts arise. It is operationalised in the VTS through the Priority Framework in the Design & Procurement phase.

- Link ambitions to realised outcomes

The empirical research showed that circular goals are rarely evaluated in a structured way, which makes it difficult to know whether initial ambitions were achieved. This principle emphasises the need to explicitly connect ambitions set in the initiation phase with realised outcomes at the end of the project. It is integrated in the VTS through the Evaluation Note, which records the degree to which goals were achieved, explains any divergences, and identifies key lessons.

- Enable learning for future projects

The empirical research highlighted the absence of organisational learning. This means that lessons from one project are not captured and applied in the next project. This principle requires that knowledge from trade-offs and outcomes is systematically documented and shared. This can be seen in the VTS through the Evaluation Note and the feedback loops that ensures lessons learned are carried into future projects.

5.3   The Value Trade-off System

The Value Trade-off System (VTS) is designed to provide a structured method for addressing value trade-offs that arise in public space projects. Instead of relying on ad-hoc decisions or individual preferences as is the case now in the municipality of Rotterdam, the VTS offers a stepwise approach that a transparent trade-off of values. The VTS is structured into the 4 project phases that can be seen in Figure 17. Each phase produces specific outputs that build on one another. In this section, the phases of the VTS are explained.

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5.3.1 The Initiation phase

In the Initiation phase, the foundation of the VTS is established through two key elements: identifying the values relevant to the project and translating these values into concrete goals.

Values

The starting point of the VTS is a shared agreement on the values that are important for the project. In this study, values in the public space were identified through a systematic literature review and empirical research. These values are proposed as an initial set for creating a circular public space, but they are not fixed and can be adapted to the local context. Although circularity is often described in theory as a principle or strategy, in practice municipal actors frequently framed it as a value in itself . For that reason, circularity is included here alongside other values such as accessibility, aesthetics, biodiversity, climate regulation, and safety. Each value is defined in clear language to support consistent interpretation across disciplines and stakeholder groups. Documenting values at the first stage ensures that subsequent discussions are grounded in a shared understanding and prevents new values from being introduced informally and inconsistently later in the process.

Goals

Once the values are established, they are translated into goals. This is the crucial step that moves from broad word to concrete ambitions. Each goal is phrased in operational terms, making it clear how and where it will be verified, whether in design drawings, technical specifications, or during site execution. For example, circularity may be translated into the goal '*Prefer reused paving stones over new stones*'. This translation process ensures that ambitions are made actionable, rather than remaining abstract principles. Threshold requirements, such as safety standards and legal norms, are included as goals as well. These threshold goals will be treated differently in the next phase.

From values to goals

The systematic conversion of values into goals ensures that values which are important for the municipality become operational without losing their conceptual grounding. Because the starting point of the VTS is explicitly value-based, this VTS contributes to value-based project management ('waardegestuurd projectbeheer'). The values are not randomly chosen, but derive both from the academic literature and from the perspectives of municipal

professionals in various positions. This dual foundation emphasises the relevance and importance of this VTS.

Output

The main output of the initiation phase is the Ambition Note. This document records the agreed values and the Goals List. It serves as a shared reference point throughout the project. By establishing this structured foundation, the initiation phase ensures that values are not forgotten as the project progresses.

5.3.2 Design and Procurement phase

The design and procurement phase builds directly on the outcomes of the initiation phase. Whereas initiation focuses on identifying and structuring ambitions, this stage translates them into enforceable requirements and uses them as the basis for evaluating design options. This ensures that the values defined earlier are embedded in contractual documentation and that trade-offs between them are addressed consistently and transparently.

From goals to requirements

The Goals List is then converted into requirements for the PvE. In the context of this VTS, a goal is a concrete ambition derived from values, expressed in clear and verifiable terms. A requirement, by contrast, is the formal translation of that goal into a binding statement within the program of requirements (PvE). Requirements therefore carry contractual weight: they specify exactly what must be delivered by designers or contractors and provide the benchmark against which compliance is checked. In other words, goals express what the project team wants to achieve, while requirements define what must be done in practice. These requirements are phrased in specific, technical, and enforceable language so that they are both clear to all project participants and verifiable in procurement and execution. Unlike goals, they leave no room for interpretation, but set a measurable standard. An example of a requirement which is based on a circular goal: '*At least 60% of the street furniture in this project must be recycled*'.

Priority framework

Once the requirements have been established, a priority framework is introduced to resolve trade-offs when goals cannot all be achieved simultaneously. Threshold requirements, such as requirements resulted from the value 'safety', are treated separately as non-negotiable. These

requirements must always be met. The remaining requirements are prioritised to reflect the overall ambitions of the project. This ensures that when trade-offs arise between two requirements, decisions are not left to personal preference, but follow an agreed order of priority. The framework thus provides transparency, consistency, and fairness in prioritising ambitions over one another.

For example, a circular requirement for reusing at least 60% of paving materials may come into trade-offs with an accessibility requirement demanding perfectly even walking surfaces. Reused stones might introduce small irregularities, while new stones ensure uniformity. The priority framework provides the guidance needed to decide which ambition takes precedence.

Appraising options

In the design process, multiple alternatives may be available for the same element of the project. To evaluate these alternatives, the VTS applies a systematic appraisal framework based on a five-point scoring system:

1 – Not acceptable: breaches a threshold requirement and must be rejected or redesigned.

2 – Makes harder: creates a clear trade-off with a requirement, requiring significant mitigation or compensation.

3 – Neutral: has no meaningful effect on the requirement.

4 – Helps: supports the requirement moderately but not across the entire scope.

5 – Helps a lot: strongly advances the requirement with minimal downsides.

Each option is scored across all relevant requirements, with short justifications recorded for each score. Constraints are explicitly integrated into this process. This study identified four constraints: planning, budget, Logistics and feasibility. In this phase they are specified, meaning that budget limits, planning schedules, logistical possibilities, and technical feasibility are clearly defined and no longer abstract. When an option is downgraded because of such constraints, this is recorded together with the mitigation strategies attempted.

The appraisal is carried out collectively by the project team, which always include the project leader, relevant advisors, and designers and other relevant professionals, dependent on the project. The project leader is responsible. This ensures that different professional perspectives are considered and that the evaluation is not the view of a single actor.

Output

The design and procurement phase produces three key deliverables. First, the programme of requirements (PvE), in which the agreed goals are translated into enforceable requirements and embedded in the project's contractual framework. Second, the prioritisation framework, which provides a structured hierarchy for solving trade-offs between requirements and serves as a reference point throughout the subsequent phases. Third, the Decision Record, which consolidates the appraisal of design options, the reasoning behind the preferred choices, and the documentation of how constraints such as planning, budget, logistics, and technical feasibility were addressed.

5.3.3 Execution phase

The execution phase is where the project moves from design into realisation. In this stage, requirements and trade-offs are no longer theoretical, but confronted with the practicalities and limitations of the real world. Changes on site are inevitable, whether due to unforeseen conditions, contractor proposals, or shifts in available materials. Without a clear process, ambitions in the initial phase could fade during realisation. The VTS therefore introduces therefore the Trade-off Ledger.

The Trade-off Ledger

The Trade-off Ledger (ToL) is a document that registers all changes, trade-offs and decisions which are made during realisation. Each entry records the location, the nature of the change, which requirement is affected, the constraint or factor that triggered it, the mitigation strategies attempted, the final decision, the consequence and any compensation measures applied elsewhere in the project.

An illustration can be drawn from the value 'climate regulation'. This value was translated into a goal, and subsequently a requirement, that permeable paving should be applied in the street of a certain project to support infiltration and reduce surface water runoff. However, during execution it was found that the soil conditions on site were not suitable for this type of paving. According to the priority framework, the technical feasibility constraint had to be acknowledged, and because this requirement held a high priority, the solution was to replace the permeable paving with conventional paving at that location. To compensate, additional green infiltration strips were introduced elsewhere in the project to ensure that the broader water management ambition remained safeguarded. This adjustment, together with its

justification, the applied prioritisation, and the possible compensation measures, must be recorded in the ToL to ensure that both the reasoning and its consequences remain transparent and verifiable.

Output

The main output of the execution phase is the Trade-off Ledger. By requiring every trade-off to be documented, silent compromises are prevented and the integrity of the values established in earlier phases is maintained.

5.3.4 Evaluation phase

The last phase consists out of two parts. First, the ambitions derived from the values are compared and checked with the outcomes of the project. Second, lessons are captured that can inform future projects and improve the Value Trade-off System (VTS) over time. The system is namely not static or perfect, but a living system that continuously improves through practice and progressively aligns with the organisational routines of municipalities.

Comparing goals and outcomes

Evaluation begins by systematically comparing the realised project against the Goals List and the prioritisation framework established earlier. Each requirement is assessed to determine the extent to which it has been achieved. Where discrepancies are found, they are linked back to the relevant Decision Notes or Trade-off Ledger entries, ensuring that deviations are explained rather than ignored. This directly addresses one of the key issues identified in the problem statement and findings: circularity ambitions are often not realised, and the reasons for this remain implicit and untraceable. By explicitly recording decisions and their justifications, the VTS makes it possible to see why ambitions were not achieved in particular cases. If such deviations occur repeatedly within or across projects, patterns can be identified that reveal which constraints most frequently block circularity, thereby providing valuable input for improving both practice and policy.

Capturing lessons learned

Additionally, the evaluation phase explicitly seeks to capture lessons for future projects. This may include identifying which requirements worked well, which constraints most often limited ambitions, or which compensations proved effective

Output

The main output of the evaluation phase is the Evaluation Note. This document summarises
the degree to which goals were achieved, explains any divergences, and highlights key
lessons to be carried forward. Together with the outputs of the earlier phases (Ambition Note,
the program of requirements (PvE), the prioritisation framework, the Decision Record, and
the Trade-off Ledger), the Evaluation Note ensures that each project contributes to an
growing body of knowledge within the municipality.

In this way, the VTS does not end with a single project, but evolves through practice,
gradually strengthening structured and transparent value-based decision-making in the public
space.

5.4   Visual illustration of the VTS

An illustration of the VTS described in section 5.2 can be seen in Figure 18 on the next page.
A Dutch version can be seen in Appendix E.

Lessons learned feed into future projects

Refinement of values

Improved project start

INPUT

Values (Specific per project):

Physical environmental comfort
Ecological sustainability
Pollution reduction
Natural resources conservation and
restoration
Biodiversity
Financial sustainability
Economic viability
Economic vitality
Spatial Functionality
Spatial Safety
Spatial diversity
Spatial accessibility
Cultural sustainability
Social well-being
Public awareness and perception
Community involvement
Sustainability
Climate regulation
Quality
Social inclusivity
Aesthetics
Availability

INPUT

Ambition Note

INPUT

PVE
Priorisation Framework
Decision Record

INPUT

All project-specific data generated in the preparation and execution of the project

Initiation phase

Translating the values in broad goals / ambitions

Values → Goals

Design & Procurement phase

Goals → Specific and measurable requirements

Priority framework

Appraising options

Execution phase

Implementation of requirements

Recording trade-offs and decisions

Managing constraints

Evaluation phase

Comparing the initial goals with the realised project.

Capturing the lessons learned from the project

Contributing to a growing body of knowledge in the Municipality

OUTPUT

Ambition Note:

This document records the agreed values and a list of the goals/ambitions which results from these values

OUTPUT

1. PVE
The program of requirements, in which the agreed goals are translated into enforceable requirements.
2. Priorisation Framework
A structured hierarchy for solving trade-offs between requirements and serves as a reference point throughout the subsequent phases
3. Decision Record
The appraisal of design options, the reasoning behind the choices, and the documentation of how constraints such as planning, budget, logistics, and technical feasibility were addressed.

OUTPUT

Trade-off Ledger
This document registers all changes, trade-offs and decisions which are made during the realisation of the project. Each entry records the location, the nature of the change, which requirement is affected, the constraint or factor that triggered it, the mitigation strategies attempted, the final decision, the consequence and any compensation measures applied elsewhere in the project.

OUTPUT

Evaluation Note
This document summarises the degree to which goals were achieved, explains any divergences, and highlights key lessons to be carried forward.

Figure 18 - Visual illustration of the conceptual framework: The Value Trade-off System. Based on the principles explained in Section 5.2 (Own work, 2025).

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5.5   Illustrative case example of the VTS

To illustrate how the Value Trade-off System (VTS) can be applied, this example follows the hypothetical redevelopment of *Noorderplein*, a 3,000 m² neighbourhood square in Rotterdam. The VTS structures how these values are made explicit, translated into goals and requirements, and tested against the practical realities of design, procurement, construction, and evaluation.

Initiation phase

In the initiation phase, stakeholders articulate which values should guide the redevelopment. In the description of the VTS in Section 5.4, all the values identified in the literature review and empirical research were considered as potential input for this phase. For the purpose of illustration, however, a smaller selection is used in this example to keep the case concise and focused. This selection demonstrates the logic of the VTS without reproducing the full range of values.

Values and goals

- **Circularity** → *Goal:* Reduce extraction of primary resources and maximise reuse of existing elements.

- **Climate regulation** → *Goal:* Improve the square's contribution to water infiltration and mitigate heat stress.

- **Aesthetics** → *Goal:* Preserve the representative character of the square, ensuring that reused elements do not create a sense of neglect.

- **Economic viability** → *Goal:* Deliver the project within the allocated budget and limit long-term maintenance costs.

The outcome of this phase is an *Ambition Note*, which sets out the goals linked to each value. It provides a shared compass for subsequent decisions, ensuring that choices are guided by explicitly stated values rather than only technical standards or budgetary constraints.

Design and procurement phase

In the design and procurement phase, the ambitions from the Ambition Note are made operational by translating them into measurable requirements. This creates a concrete basis for comparing design alternatives.

Goals and requirements

- **Circularity (reduce resource use):** Minimum 40% of paving material must be reclaimed from municipal stock; design for disassembly required for all new materials.

- **Climate regulation (improve infiltration, reduce heat):** Surfaces must achieve at least 60 mm/h infiltration capacity; 15% of the square must be shaded through trees or structures.

- **Aesthetics (preserve quality):** Reclaimed stones must meet agreed visual criteria; colour variation acceptable within ±15% to preserve uniformity.

- **Economic viability (budget control):** Total cost may not exceed €2.5 million; life-cycle costs must be presented for 30 years.

Based on these requirements, the project team develops three options:

- **Option A:** Full reuse of reclaimed stones, with minor cleaning and sorting.

- **Option B:** Full replacement with new permeable and uniform paving.

- **Option C:** Hybrid solution – 50% reclaimed stones in low-risk zones, 50% new permeable stones in main areas, combined with additional trees for shade.

The VTS then structures the evaluation:

- **Weighting:** Stakeholders assign relative importance: climate regulation (0.30), circularity (0.25), economic viability (0.25), aesthetics (0.20).

- **Scoring:** Each option is scored 1–5 against the requirements. Option A excels on circularity but fails infiltration; Option B meets climate and aesthetics but has high costs and low reuse; Option C balances all but requires more complex logistics.

- **Trade-offs recorded in the ledger:**

  o *Circularity vs Climate regulation:* reused stones are non-permeable, lowering infiltration.

  o *Circularity vs Aesthetics:* visible wear risks perception of neglect.

  o *Economic viability vs Climate regulation:* permeable stones and added trees increase upfront costs.

The hybrid option (C) is ultimately selected, with the VTS documenting the rationale in a prioritisation note and scoring table.

Execution phase

During construction, unforeseen dilemmas arise. The VTS ensures that these are systematically recorded and linked back to values.

Examples of trade-offs in execution

- A batch of reclaimed stones does not pass quality checks. → *Trade-off:* circularity vs aesthetics. *Decision:* stones are rejected; to maintain reuse targets, kerbstones and benches from another site are incorporated.

- Delivery of permeable stones is delayed by six weeks. → *Trade-off:* economic viability vs climate regulation. *Decision:* maintain infiltration target but adjust phasing; temporary surface installed to avoid penalties for delay.

- Unexpected costs for tree planting exceed budget. → *Trade-off:* climate regulation vs economic viability. *Decision:* reduce tree size specification, with commitment to additional planting in the next budget cycle.

At the end of this phase, the *Trade-off Ledger* provides a full trace of how practical constraints and trade-offs were managed without losing sight of the values defined earlier.

Evaluation phase

Once the square is delivered, the VTS is used to assess whether goals and requirements have been achieved.

Results of evaluation

- **Circularity:** 44% of paving mass reused (requirement exceeded); kerbstones reused successfully.

- **Climate regulation:** Infiltration tests confirm ≥ 62 mm/h; shade coverage target only partly met (12% instead of 15%).

- **Aesthetics:** Residents rated the square positively, although some noted slight colour variation in reused stones.

- **Economic viability:** Final cost exceeded budget by 4%, but life-cycle cost analysis showed savings in maintenance due to robust design.

These results are documented in an *Evaluation Note*, which also captures lessons: pre-sorting reclaimed stones improved aesthetics, and earlier engagement with suppliers could reduce delays in material delivery.

The dilemmas presented in this hypothetical case are not chosen at random but mirror the patterns identified in the empirical study. Interviews with municipal professionals repeatedly highlighted that circularity is weighed against other values and constraints y in an implicit and ad hoc manner. By embedding these same tensions in the worked example, the Noorderplein case demonstrates how the VTS can structure such recurring trade-offs in a transparent way. This connection ensures that the example does not stand apart from the research, but instead illustrates how the framework responds directly to the issues observed in practice.

6. Discussion

The aim of this study was to understand how values are interpreted and weighed in circular public space and to propose a conceptual system to support this process. The discussion reflects on how the findings address this aim. First, the findings are interpreted by considering the literature, the empirical case study, and a comparison between the two. The VTS is then evaluated as a conceptual framework, highlighting its potential and its limitations. Finally, the chapter reflects on the methodological approach and the implications this has for the interpretation of the results. In doing so, the discussion provides a bridge from the presentation of results to the conclusions of the thesis.

6.1   Interpretation of the results

This study conducted a literature review and an empirical research. Both methods resulted in results which were presented in the previous chapters. In this section, these results are interpreted.

6.1.1   Interpretation of the Literature Review

Theoretical background and the three core concepts

Before the SLR was performed, a Theoretical Background study was performed in which the three core concepts of the study were introduced and explained: Circular Economy, Sustainable value creation and the Public space. In this process, the relation between the circular economy and sustainable creation was proved by examining CE definitions and answering the first sub-research question. Based on that, the link between CE and sustainable value creation can be conceptually established: the aim of CE is to contribute to environmental, economic and social values. At the same time, the literature reveals variation in emphasis across the identified CE definitions in this study. Some are primarily material oriented, while others emphasise sustainable development as a (primary) goal of the CE.

As was stated in the knowledge gap, the link between CE and sustainable value creation is underexplored. This thesis addresses that gap by making the connection explicit and showing how CE can translate into environmental, economic and social value in practice. Studying this in the specific context of public space influences the results, as public space introduces an additional dimension. Taken together, the public space lens shifts the CE-value question from

asking whether CE creates value to asking which values are prioritised, at what stage in the process, and how those priorities are maintained. This is precisely why the thesis proposes a phase-based VTS to translate CE ambitions into realisation.

Systematic Literature Review

The first aim of the SLR was to examine whether the term 'circular public space' is used in academic literature. The reason why this term is chosen is explained in 3.3.2. The result of the SLR was that this term is not used in literature. This gap means guidance on circularity remains outside the public space frame, and public space guidance rarely integrates with the CE. The thesis therefore uses circular public space as a practical term that connects these two established concepts.

The second aim was to identify environmental, economic and social values in the circular public space. As this term is not used in literature, this resulted in an alternative approach where the circular public space was changed with the general public space in CE or sustainable context. The results are 5 environmental values, 3 economic values and 9 social values which can be seen in Table 1, 2 and 3. So, the social dimension is overrepresented in the public space. This is in contrast with multiple studies that been conducted in the general field of CE (Zavos et al, 2024; Kircherr et al, 2017; Geisddoerfer, 2017). They concluded that the social dimension of CE (in general context) is underrepresented in comparison with the environmental and economic dimension. This difference in representation of the social dimension is best explained by concluding that the social aspect is the core element of the public space. So by performing this study in the specific context of the public space, the centre of gravity has shifted from the environmental and economic dimension to the social dimension.

Another observation that the social values appear more differentiated, with nine distinct items that describe specific values like safety and accesibility, whereas the environmental and economic values are more phrased into broader categories like biodiversity and economic vitality. This uneven level of detail suggests that academic literature on public space articulates the social dimension in clearer language that are closely tied to spatial design and use. The environmental and economic values are treated more as higher-level themes that aggregate multiple mechanisms.

6.1.2 Interpretation of the Empirical Findings

In contrast to the literature, the term 'circular public space' is recognised and used in practice. The term is unanimously linked to the reuse of materials. Reuse is actually a strategy of the CE as can be seen in Figure 19 (strategy R3).
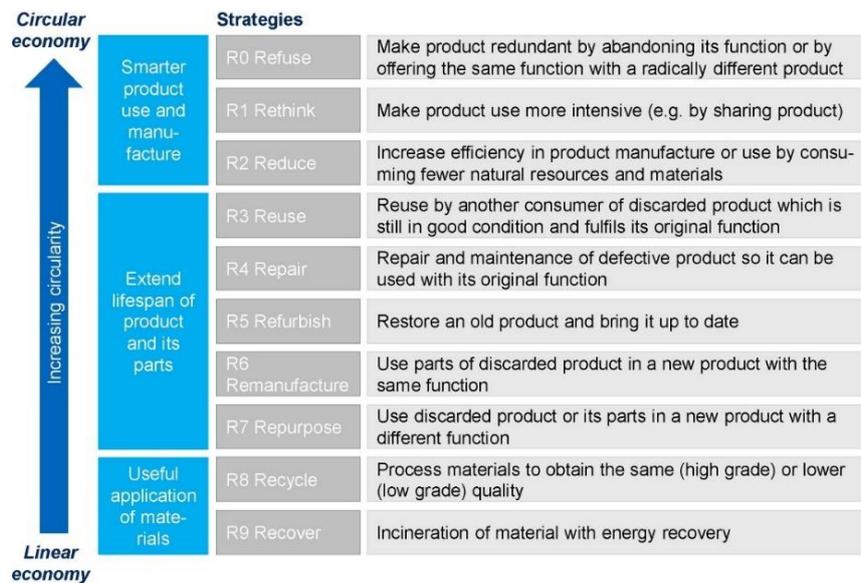
Figure 19 - The 9 circular strategies of the circular economy (Kircherr et al., 2017).

By defining circular public space primarily as reuse of materials, practitioners show that they hold a material focused perception of circularity. A possible reason is the sphere of control: reuse fits within a project team's possibilities (they can easily reuse materials from another project), whereas higher-order strategies like refuse, rethink or remanufacture often require policy or network changes beyond the team. It's also highly visible and communicable. Residents can see and recognise reused elements in the street, so it becomes the easiest story to tell and defend. Reuse of materials is also the fastest circular solution under time and budget pressure. Based on these reasons, the reuse of materials becomes the default expression of 'doing circular'. The consequence is a narrowing of the circular agenda: higher-leverage strategies and sustainable value aims of CE risk receiving less attention.

As for the identified value trade-offs in the empirical study, circularity is always interpreted as the reuse of materials as can be seen in the explanation column and the examples that were given during the interview. Two types of trade-offs were identified: those between a value and a constraint, and those between two values. In all the given examples, circularity or the reuse of materials was mention in each trade-off. This shows that circular ambitions are not

dismissed outright at the start, but rather weighed against other priorities in the project context. What was clear from the findings is that such trade-offs are managed implicit, meaning that the reasoning behind choices is not documented or structured. This emphasises the need for a tool or system that direct the process to a more explicit and structured process.

6.1.3 Comparison between literature and empirical findings

The comparison between literature and practice shows that there is a partial overlap in values associated with the circular public space, as a large part of the values identified in the literature were also mentioned by municipal professionals. In total, nine values overlapped, as can be seen in Table 13. This overlap suggests that academic literature are not entirely disconnected from practice.

Table 13 - Comparison of values in the circular public space between theory and practice (Own work, 2025).

Values identified	Identified in Literature study	Identified in the empirical study	Identified in both studies
Physical environmental comfort	X		
Ecological sustainability	X		
Pollution reduction			X
Natural resources conservation and restoration (This value is called resource consciousness in the empirical findings)			X
Biodiversity			X
Financial sustainability	X		
Economic viability	X		
Economic vitality			X
Spatial Functionality			X
Spatial Safety			X
Spatial diversity	X		
Spatial accessibility	X		
Cultural sustainability	X		
Social well-being			X

Public awareness and perception	X		
Community involvement (this value is called participation in the empirical findings)			X
Climate regulation		X	
Quality		X	
Social inclusivity		X	
Aesthetics		X	
Accessibility		X	

The comparison between literature and practice shows that certain values are emphasised in academic sources but are not recognised in municipal practice, while others emerge strongly in practice but remain absent in the literature. This difference could be explained by the orientation of each domain: literature often stresses normative and long-term sustainability concerns, whereas practice tends to prioritise values that are directly tied to project delivery and community expectations. At the same time, a set of shared values appears in both domains, reflecting areas where academic debate and municipal priorities overlap. These overlaps provide a common ground, but the asymmetries highlight a partial misalignment between theoretical perspectives and practical priorities. Future research could investigate exactly for each value why it is not mentioned in literature and practice.

6.2   Reflection on the Value Trade-off System

The reason why the VTS is designed is explain in the introduction chapter of chapter 5. This section offers a critical reflection on how this system is designed and how this system could contribute to municipalities.

An obvious strength of the system is that it makes value choices visible and verifiable at the moment when decisions actually matter. By requiring short and written justifications for each trade-off, it shifts decisions from person-dependent judgement to a transparent and objective process. This shift improves trustworthiness and traceability within the municipality. The likelihood of circular aims quietly fading as the project evolves is minimised. This also enables diverse fields, design, and even procurement and operational to have a common language to facilitate resolving disagreements without reverting to subjective preferences.

Another strength is that the VTS contributes to stabilising a full value portfolio. In a practice environment where circularity is by most equated to be simply material reuse, the VTS captures the environmental, economic and social aims of the CE together. This stimulates that the project is driven by values which are important for the municipality instead of constraints like planning and budget. There is also potential for the VTS to improve as it is used. Because each project generates outcome documents and a closing evaluation, the system creates a feedback loop: recurring patterns and pain points become visible, indicators can be calibrated, and thresholds can be adjusted to the specific project.

There are also some weaknesses in this VTS to acknowledge. The first one is the administrative burden. If templates become long or duplicative of existing project documents, project teams will perceive the VTS as extra paperwork and treat it as a box-ticking exercise. This is especially the case in the phases when the project is going on (Design and procurement phase and execution phase), as the planning could be tight in practice.

The VTS could also be perceived as a heavy and complex system by professionals, and this can pull attention away from the project's core objectives. The teams spend time completing forms, duplicating information, and debating process over values. This risks decision delays, 'box-ticking' behaviour, and reduces creativity of the project team. This could be mitigated by simplifying the system or prefilling data from previous projects.

Finally, culture and capability matter. The VTS presumes a willingness to articulate value in clear terms and to defend choices transparently. Not everyone within an organisation is equally comfortable with this. Without specific training and well-chosen examples, early pilot projects may drift back to familiar habits where project teams decide and weigh values against each other without documenting or following a transparent process. In other words, the VTS can help align day-to-day decision-making with the project's goals, as long as the system is presented with realistic expectations.

6.3   Implications for research methods

The methodological design of this study, combining a systematic literature review with an empirical case study, carries implications for the type of knowledge that has been generated.

The abductive approach ensured that theory and practice were not treated as separate domains but as sources of insight that informed each other. The literature revealed a conceptual absence around circular public space and value trade-offs, while the interviews provided practice-based dilemmas and interpretations of value. Bringing these two elements together enabled the development of the Value Trade-off System (VTS) as a conceptual synthesis. The resulting framework should therefore be understood less as an empirical generalisation and more as a theoretical proposition grounded in practice.

This design also demonstrates the value of abduction in circular economy research. A strictly deductive design would have tested predefined concepts from the literature, which would not have been possible given the absence of definitions of circular public space or value trade-offs in academic sources. A strictly inductive design would have captured practice-based insights but risked producing only context-specific findings. The abductive strategy bridged these extremes: it enabled new concepts to emerge from practice, but always in dialogue with theoretical debates. The implication is that abductive research can play an important role in advancing under-theorised areas of the circular economy, particularly where academic and professional vocabularies are misaligned.

The exclusive reliance on semi-structured interviews had consequences for the nature of the evidence. Interviews capture how professionals articulate their understandings, but they do not directly observe how trade-offs are enacted in meetings, contracts, or design processes. The findings therefore represent discursive interpretations of trade-offs, not direct behavioural accounts. This distinction is important: the VTS was derived from how actors talk about dilemmas, rather than from observational or quantitative measurements of decisions. While this reliance on narratives is not a weakness in itself, it implies that the framework reflects the reasoning structures of professionals more than the observable outcomes of projects.

Taken together, these methodological reflections suggest that the findings of this study are best read as a conceptual contribution, rooted in empirical material but shaped by abductive reasoning and interpretive analysis. The implications are twofold. First, the study demonstrates the potential of abductive, qualitative approaches for developing new concepts in circular economy research. Second, it highlights the need for subsequent studies to complement such approaches with co-design, pilot testing, and triangulation, so that conceptual frameworks like the VTS can be critically validated and refined through broader methodological lenses. Future research should therefore combine abductive approaches with observational or co-design methods, to validate frameworks not only as conceptual models but also as practical instruments.

7. Conclusion

This chapter presents the conclusions of the study by answering the research questions. Each sub-research question is addressed in turn, followed by the main research question.

SRQ1: To what extent is the circular economy linked to sustainable value creation?

The literature confirms a strong link between the circular economy (CE) and sustainable value creation. The numerous definitions of CE show that sustainable value creation is an aim of the circular economy, even described by some sources as the 'principal aim' (Kirchherr et al., 2023). This link is often framed through the Triple Bottom Line of environmental, economic, and social value.

SRQ2: How is value conceptualised in academic literature relevant to circular public space?

a. *How is circular public space defined in academic literature?*

The SLR shows that the term *circular public space* is absent in academic literature, revealing a conceptual gap. This absence makes it particularly relevant to explore whether the term is directly understood in practice.

b. *How are values in circular public space described in academic literature?*

Because the term itself is not used, values in circular public space could not be identified directly. Instead, values in the public space within a CE or sustainability context were examined as an alternative approach. In total, 17 values were identified in the academic literature, of which 9 were social, 5 environmental, and 3 economic (Tables 1–3). This indicates that, in contrast to broader CE research where the social dimension is often underrepresented (Zavos et al., 2024; Kirchherr et al., 2017), literature relating to public space already gives notable attention to social aspects.

c. *How are value trade-offs in the development of circular public space described in academic literature?*

No literature was found addressing value trade-offs in circular public space development. This absence was expected, as such trade-offs are typically encountered in practice rather than theorised in academic literature.

SRQ3: How is circular public space interpreted in practice, and what values are associated with it?

In practice, circular public space is recognised, in contrast to academic literature. The term is mainly interpreted as the reuse of materials. Professionals also link it to themes such as closing lifecycles and reducing waste. The respondents mentioned 45 times values associated with circular public space, of which 19 were social, 10 environmental, and 16 economic (Table 9). This shows that social values are frequently emphasised in practice. The prominence of social values in both literature and practice highlights that the circular public space context diverges from the general circular economy, where social aspects are typically underrepresented as explained in the answer of SRQ2.

In short, the conclusion regarding the prominence of social values is grounded in the empirical and literature-based counts presented in Tables 1–3 and 9, where social values were identified more frequently than environmental or economic ones.

SRQ4: How are trade-offs between different values made in the development of circular public space, and what barriers influence this process?

Trade-offs are made implicitly and ad hoc, often weighing circularity (commonly reduced to material reuse) against values and constraints such as budget and planning. The empirical study identified multiple types of trade-offs (summarised in Table 11), including circularity versus aesthetics, functionality, timing, cost, and climate regulation. In all of these, circularity is consistently positioned as one side of the dilemma, weighed against competing values or project constraints. As these processes are undocumented, circular ambitions gradually fade and the rationale behind decisions remains unclear.

MRQ: How can value trade-offs be understood and supported in the development of circular public space projects?

The findings show that value trade-offs in circular public space are best understood as implicit and ad hoc negotiations, where circularity is balanced against other values and project constraints. As these negotiations remain undocumented and untraceable, circular ambitions tend to fade as projects progress.

To support this process, the study developed the Value Trade-off System (VTS), a conceptual framework that makes values explicit, translates them into concrete goals and requirements, and systematically records the dilemmas and choices that arise across project phases. The VTS should be understood as a first conceptual step rather than a finished product or tool that can be directly applied in municipal practice. It provides a structured basis for project teams

to address value trade-offs in a more explicit and transparent way. By linking values to concrete requirements, applying weighting to clarify priorities, and recording decisions through the Trade-off Ledger, the VTS strengthens transparency and accountability in decision-making. Moreover, by integrating iterative reflection across project phases, the framework enables learning and makes it possible to trace how and why circular ambitions were upheld or compromised.

This study is the first to propose a structured framework for addressing value trade-offs in circular public space projects, filling a conceptual and practical gap identified in both literature and practice. It thereby closes the thesis with a foundation for more transparent and balanced approaches to decision-making in the development of the circular public space.

7.1   Contribution to theory and practice

To the author's knowledge, this is the first study to propose a structured framework for value trade-offs in circular public space, directly addressing the conceptual and practical gap identified in both literature and practice.

The study contributes to theory in multiple ways. First of all, it introduces the term 'circular public space' as a workable term that links circular economy principles to the public space. This fills a clear gap in the academic vocabulary and gives researchers and practitioners a first research on this subject. Secondly, this study showed and proved the link between CE and sustainable value creation, how value in this context is specified and discussed through environmental, economic, and social dimensions. Further on, this research explains process dynamics like why circular ambitions often narrow to material reuse and fade across project phases by combining literature and interview evidence. Finally, this study contributes to a clearer theoretical understanding of which values are prioritised in the public space, how this process works, and what trade-offs play a role in the public space.

For practice, the study shows that value trade-offs in municipal projects are often implicit, made under time and budget pressure, and are not documented or evaluated. The consequence is that circular ambitions fade while other values drop out. Municipal workers cannot find out afterwards why choices were made and how trade-offs between values went down. The VTS addresses this problem by translating the identified values into concrete goals and requirements, putting key constraints on the table, and demanding for short written rationales with outputs. This makes decision-making explicitly values-based rather than materials-first, keeps the full value portfolio in view at each

7.2   Limitations of the study

This study was conducted within a single municipality. That focus enables depth and contextual nuance, but it limits transferability. Municipal contexts can differ both within the Netherlands and internationally. The findings reported here should therefore be read as analytic insights rather than statistically generalisable claims. They are most applicable where conditions are comparable (large, urban Dutch contexts). Smaller municipalities or cities with different institutional setups may face different constraints and trade-offs. Future work should replicate this study and compare across multiple municipalities to test and validate the empirical findings.

The central term in this study, the *circular public space*, is not yet settled in the academic literature. The study operationalises this concept by synthesising related notions (circular economy, public space, sustainable value) and translating these into a new academic definition. This brought novel insights, but also sets boundaries. A different, equally reasonable definition could have led to different value interpretations, patterns, and conclusions. Because no agreed benchmark exists, the definition cannot be independently checked for completeness, and comparisons with other studies are more difficult. Two risks follow: (1) a mismatch between academic terminology and how practitioners describe their work, and (2) a tendency to interpret evidence through the chosen lens. The definition should therefore be understood as a concept introduced for the scope of this study, not as a universal standard.

This study relied on ten interviews with municipal professionals, including project managers, advisors, an area manager, a designer, and a transition director. This mix of functions provided valuable insights into how circularity and values are interpreted within the municipality, and recurring themes across interviews suggest that the sample was sufficient to capture shared tendencies. Contractors and suppliers influence feasibility and costs, while residents and community organisations affect social values, meaning that some insights remain outside the scope of this research.

The adequacy of the sample can be considered in light of the literature on qualitative saturation. Hennink and Kaiser (2022) conclude in their systematic review that saturation in relatively homogeneous study populations is typically reached between 9 and 17 interviews, with an average of twelve to thirteen. With ten interviews, this study therefore falls within the empirically supported range for saturation, although it should be recognised that saturation here applies only to the municipal perspective. For that reason, the findings should be read as

indicative of internal municipal logics rather than representative of all stakeholders in circular public space projects. Future research could test the robustness of these findings by broadening participation to include external actors such as contractors, suppliers, and residents, whose priorities may shift the balance of values in different ways.

This study was conducted by a single researcher, which means that several steps in the process relied on individual judgement. In the case of the systematic literature review, a core issue is that the selection of databases, search terms, and inclusion criteria inevitably shapes which publications are retrieved. Likewise, in the empirical research, the absence of inter-coder checks or co-analysis means that alternative interpretations of the data are possible. These forms of subjectivity do not invalidate the findings, but they may affect reliability and comparability, as another researcher might process the material differently. Transparency in the coding process and careful traceability of interpretations mitigate this limitation to some extent, although they cannot remove it entirely.

Finally, the proposed VTS has not been validated by municipal professionals in this study. It was derived from interview insights and literature findings, but it was not co-designed, piloted, or tested with those who would apply it in practice. Its practical fit is therefore uncertain. The VTS should therefore be read as a prototype framework. The logical next step would be a validation cycle (e.g. walkthroughs of past projects, think-aloud sessions with project leads, and pilots) to test and align the framework more effectively with municipal practice.

7.3   Recommendations

The recommendations for the municipalities have already been described in the previous sections. This section presents a couple of recommendations for future research.

First of all, the Value Trade-off System (VTS) developed in this thesis should be validated in practice. Pilot applications in municipal projects should test the feasibility of this system and reveal practical obstacles. Based on this, the application and additional value of the VTS should be revised to fit better into current project management.

Secondly, the scope of actors involved could be expanded in future research. This research focused only on municipal professionals and excluded the experiences of contractors, suppliers, residents, and community organisations. They also play an important role in shaping the trade-offs and how CE is implemented in the public space. Including these groups

would provide a more complete view of how values are weighed in circular public space projects.

Thirdly, the findings are limited to the context of the municipality in Rotterdam. It is recommended to perform this same study across multiple municipalities to investigate the transferability of the findings and highlight differences in institutional settings.

Fourth, this study identified the values associated with circular public space in both literature and practice, and highlighted where they overlap and where they diverge. However, the reasons why specific values are absent, underrepresented, or emphasised differently in the two domains were not investigated in detail. Future research could therefore examine each value more closely, to uncover the underlying causes of these differences. Such work could provide a deeper understanding of why certain values gain prominence in academic debates but not in practice, or vice versa, and how this shapes the interpretation of circular public space.

Finally, future research should further investigate why, in practice, circularity in public space projects is often narrowed down to the reuse of materials. Reuse is only one of many circular strategies, alongside reduction, refurbishment, remanufacturing and others. The dominance of reuse suggests that other strategies are either overlooked, perceived as less feasible, or insufficiently embedded in municipalities. A more systematic inquiry into this phenomenon is needed to understand why there is a big emphasis on reuse and how this phenomenon is driven. Such research should be conducted on a larger scale by comparing public space projects across different municipalities, organisations, and project contexts. This would make it possible to identify recurring barriers and enablers, and to explore how a broader set of circular strategies could be integrated into practice.

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Appendices

[See the following pages for the appendices.]

Appendix A.
Values in the public space: Frameworks from the literature

A.1 Framework 1 (Bambó Naya et al., 2023)
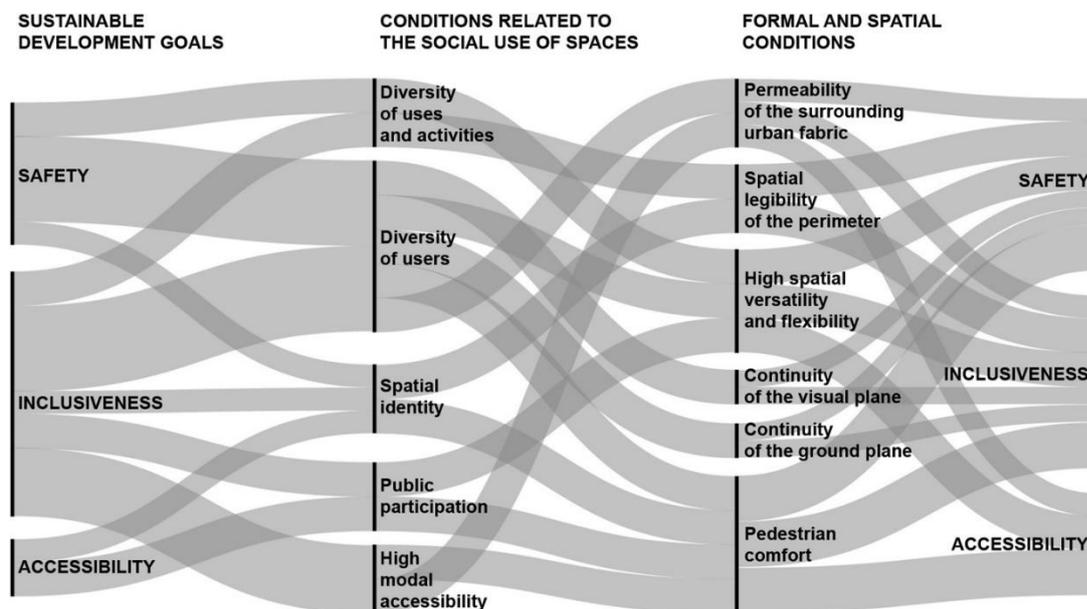
A.2 Framework 2 (Jung et al., 2025)

Environmental sustainability	Economic sustainability	Social sustainability
- Ecosystem stability	- Economic growth	- Human rights
- Carrying capacity	- Fair distribution	- Participation
- Biodiversity	- Efficiency	- Social mobility
- Global environmental issues		- Social cohesion
		- Cultural essence
		- Development of institutions

A.3 Framework 3 (Yang et al., 2023)

Value Dimension	Value Composition	Exposition	Literature Bases
Q1 Physical Environment Comfort	C1-Sound environment	No noise pollution in outdoor spaces	Yasushi (2001) [19]
	C2-Light environment	Main outdoor activity areas have good sunshine conditions without dark and claustrophobic corners	
	C3-Wind environment	Ventilated outdoor space, suitable windspeed, good air flow	
	C4-Air quality	Fresh air in outdoor space without hazardous substances and odors	
	C5-Thermal Comfort	Comfortable temperature	
	C6-Outdoor space size	Appropriate outdoor space size, not too crowded nor too empty	
Q2 Spatial Functionality	F1-Functional complexity	Space has multiple functions instead of one single function	Xu (2009) [22], Saiedlue et al. (2015) [25]
	F2-Functional scale	Number of functional spaces and size of each space meet residential needs	
	F3-Function age-range	Spatial facilities meet the needs of people of all ages	
	F4-Function time-range	Outdoor space satisfies the needs of residents in various climatic conditions and time periods	
Q3 Spatial Safety	S1-Daily safety	Outdoor space ensures the safety of residents' daily activities, no hidden dangers such as falling objects, collapse, and traffic safety.	Yasushi (2001) [19], Shu et al. (2018) [28], Chen & Wu (2010) [39], Frances et al. (1998) [40]
	S2-Disaster prevention	Outdoor space has certain disaster prevention functions, such as: resisting and alleviating natural disasters, preventing the spread of fire, and preventing the spread of disease, etc.	
	S3-Social safety	Outdoor space ensures social safety, without hidden danger of fighting, theft, abduction, and other illegal and criminal acts	
	S4-Hygine safety	Outdoor space is hygienic, without infectious diseases mediated by microorganisms	
Q4 Spatial Diversity	D1-Spatial layering diversity	Outdoor space has rich spatial transitions, ensures residents' sense of belonging and identity	Saiedlue et al. (2015) [25], Efrat et al. (2019) [29]
	D2-Spatial form diversity	Various forms of space (enclosed space, linear space, open space, semi-enclosed space) without stereotypes	
	D3- Outdoor space, diversity	Open space with various scales with places suitable for both group and individual activities	
Q5 Spatial Accessibility	A1-Spatial Attraction	Outdoor spaces are visible and attractive to residents	Efrat et al. (2019) [29], Chen et al. (2007) [41], Li & Lu (2005) [42], Peng (2017) [43]
	A2-Path clarity	Streamline organization of the roads is clear and concise, the destination can be easily reached	
	A3-Spatial concentration	Layout of each functional space is relatively concentrated and convenient to enter	
Q6 Spatial Sustainability	T1-Cultural sustainability	Outdoor space reflects regional cultural characteristics	Yasushi (2001) [19], Pavla & Maxmilian (2017) [27], Shu et al. (2018) [28] Zhang et al. (2019) [44], Shen (2019) [45], Efrat & Yosef (2017) [46], Li & Wu (2005) [47], Ebbesen et al. (1976) [48]
	T2-Societal sustainability	Community atmosphere is harmonious and promote a stable development of the neighborhood relationship	
	T3-Ecological sustainability	Outdoor space is ecologically balanced, with healthy environment, diverse, and ecosystem, and rationally used resources	
	T4-Financial sustainability	The resources in the outdoor space are planned reasonably in the early stage and used in the later stage without any waste	

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A.4 Framework 4 (Zhao et al., 2023)

Dimension	W	Theme	W	R	Indicator	W	R
Social	0.3784	Social wellbeing	0.0747	8	Public facilities	0.0397	7
					Public/green space	0.0350	9
		Accessibility	0.1059	3	Access to public facilities	0.0334	11
					Access to public/ green space	0.0346	10
					Housing and job proximity	0.0153	21
					Inclusive design	0.0226	15
		Housing provision	0.2248	2	Adequate housing	0.0515	4
					Affordable housing	0.1247	2
					Housing types	0.0184	16
					Quality of housing	0.0302	12
		Public awareness and perception	0.0892	5	Heritage knowledge	0.0034	29
					Sense of pride	0.0065	27
					Sense of belonging/place	0.0181	19
					Social cohesion	0.0123	24
					Social interactions	0.0114	25
					Social equality	0.0128	23
					Public satisfaction	0.0247	13
		Community involvement	0.2330	1	Public participation in regeneration initiatives	0.1837	1
					Public participation in cultural activities	0.0493	6
		Heritage and local identity	0.0813	7	Heritage authenticity	0.0182	18
					Urban pattern	0.0154	20
					Customs and festivals	0.0054	28
					Visual quality	0.0097	26
					Rehabilitation and reuse of heritage assets	0.0142	22
					Integration of old and new developments	0.0184	17
		Safety/security	0.0859	6	Safe design	0.0494	5
					Traffic safety	0.0365	8
		Transportation	0.1052	4	Provision of public transport	0.0815	3
					Access to public transport	0.0237	14
Economic	0.1448	Economic viability	0.725	1	Financial support	0.4433	1
					Attracting investors	0.3213	2
		Economic vitality	0.275	2	Job opportunities	0.1014	3
					Traditional business development	0.0361	6
					Local compatibility	0.0521	5
					Housing vacancy rate	0.0542	4
					Training and skills	0.0149	7
Environmental	0.2616	Building and land use	0.4566	1	Existing buildings reuse	0.1025	2
					Mixed-use development	0.1624	1
					Density of development	0.0746	7
					Redevelopment of contaminated areas	0.0952	4
		Ecology and landscape	0.1815	3	Natural resources conservation and restoration	0.0983	3
					Landscape	0.0831	6
		Resources and energy	0.1488	4	Energy efficiency	0.0174	15
					Renewable energy	0.0241	13
					Materials	0.0116	16
					Water access and quality	0.0457	9
					Stormwater management	0.0213	14
					Solid waste management	0.0284	12
		Pollution	0.2131	2	Air quality	0.0579	8
					Water pollution	0.0848	5
					Light pollution	0.0307	11
					Noise pollution	0.0395	10

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Appendix B.
Ethics for human research

B.1 Informed Consent

Delft University of Technology
HUMAN RESEARCH ETHICS
INFORMED CONSENT TEMPLATES AND GUIDE
(English Version: January 2022)

Participant Information/Opening Statement

You are being invited to participate in a research study titled:

"Sustainable value creation through circular economy in outdoor public spaces."

This study is conducted by Oualid el Margai, Master's student at TU Delft (Construction Management and Engineering), Faculty of Civil Engineering and Geosciences, under the supervision of Quirien Reijtenbagh.

The aim of this research is to explore how circular economy strategies contribute to sustainable value (environmental, social, and economic) in the management and design of municipal outdoor public spaces. The study is supported by the Municipality of Rotterdam. No personal or identifiable information will be shared with the Municipality or any other party.

I will perform in total 10 interviews. You are invited to take part in one interview, lasting approximately 45 minutes. You will be asked to reflect on your professional experience, share your views on circular strategies in public space projects, and discuss organisational approaches or barriers. The interview will be audio recorded with your permission, solely for transcription purposes. After transcription, the recordings will be permanently deleted.

All transcripts will be anonymised, with personal data such as names, job titles, and other potentially identifiable information removed. You will have the opportunity to review your transcript before it is used for analysis. The anonymised data will be used in a Master's thesis and will be shared through academic presentations and possibly academic publications, depending on the relevance of the results.

Data will be securely stored in the TU Delft OneDrive environment. Only the researcher (me) will have access to the raw (non-anonymised) data. No identifiable information will be included in any published materials.

Participation is voluntary. You may decline to answer any question or withdraw from the study at any time, without providing a reason and without any negative consequences. There are no known risks associated with participation.

If you have questions, or wish to withdraw your participation, please contact:

Oualid el Margai

Explicit Consent points

PLEASE TICK THE APPROPRIATE BOXES	Yes	No
A: GENERAL AGREEMENT – RESEARCH GOALS, PARTICPANT TASKS AND VOLUNTARY PARTICIPATION		
1. I have read and understood the study information dated [*DD/MM/YYYY*], or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	☐	☐
2. I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	☐	☐
3. I understand that taking part in the study involves: • Information will be captured through audio-recorded, semi-structured interviews. The interviews will be conducted one-on-one (online or in person) and recorded using a mobile phone or computer. After the interview, the audio recordings will be transcribed as text, and the recordings will be deleted immediately after transcription is complete. • The transcripts will be de-identified by removing any personally identifiable information (PII) and personally identifiable role	☐	☐

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PLEASE TICK THE APPROPRIATE BOXES	Yes	No
descriptions (PIRD), such as names, job titles, departments, and organisations. • This approach ensures that only the minimum necessary personal data are processed, and that all published results remain fully anonymous.	☐	☐
4. I understand that I will not receive any financial compensation for my participation in this study.	☐	☐
5. I understand that the study will end once the Master's thesis is submitted and evaluated, and that all personal data, including audio recordings and identifiable information, will be deleted at that time.	☐	☐
B: POTENTIAL RISKS OF PARTICIPATING (INCLUDING DATA PROTECTION)		
6. I understand that taking part in the study involves the following risks: a small possibility of discomfort when reflecting on professional responsibilities or organisational practices. I understand that these will be mitigated by ensuring that I am not required to answer any question I do not feel comfortable with, that I may stop the interview at any time without giving a reason, and that all data will be anonymised to protect my identity.	☐	☐
7. I understand that taking part in the study also involves collecting specific personally identifiable information (PII), such as my name and contact details, and associated personally identifiable role descriptions (PIRD), such as my job title, department, or references to my organisation. I understand that there is a minimal to no risk of my identity being revealed. This risk will be mitigated by removing all direct identifiers during transcription and by using only general role descriptions in the final thesis and any related outputs.	☐	☐
8. I understand that some of this PIRD is considered sensitive under GDPR legislation, specifically because it may indirectly reveal professional roles in public institutions or involvement in municipal decision-making. However, no sensitive data such as political views, religious beliefs, or criminal records will be collected. This research does not require a Data Processing Impact Assessment (DPIA) as it does not involve high-risk data categories or large-scale data processing. All efforts will be made to minimise identifiability and protect participant privacy.	☐	☐
9. I understand that the following steps will be taken to minimise the threat of a data breach, and to protect my identity in the event of such a breach: audio recordings will be stored securely on TU Delft's OneDrive environment with limited access; all transcripts will be de-identified through the removal of names, job titles, departments, and other personal or organisational	☐	☐

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PLEASE TICK THE APPROPRIATE BOXES	Yes	No
identifiers; only anonymised data will be used in analysis and reporting; and the original audio recordings will be deleted immediately after transcription. No raw data will be shared with third parties.		
10. I understand that personal information collected about me that can identify me, such as my name, job title, or organisation, will not be shared beyond the study team and will be removed during transcription to ensure anonymity in all research outputs.	☐	☐
11. I understand that the (identifiable) personal data I provide will be destroyed after the completion of the study. Specifically, audio recordings and any identifiable information will be deleted immediately after transcription, and all de-identified research data will be permanently deleted no later than three months after the final submission and evaluation of the thesis.	☐	☒
C: RESEARCH PUBLICATION, DISSEMINATION AND APPLICATION		
12. I understand that after the research study, the de-identified information I provide may be used in academic outputs such as the final Master's thesis, presentations within TU Delft, and potentially in academic articles or reports. The results may also contribute to policy discussions or the development of municipal circular economy practices. No recognisable images, direct quotes, or identifiable role descriptions (PIRD) will be published without my explicit, separate consent. All findings will be presented in anonymised form to protect my privacy.	☐	☐
13. I agree that my responses, views, or other input can be quoted anonymously in the research outputs. I understand that no identifiable information will be included in any quotes without my explicit permission.	☐	☐
14. I give permission for the de-identified interview transcript that I provide to be archived in a secure TU Delft research repository (such as 4TU.ResearchData) for future research and educational purposes.	☐	☐

Signatures

_____ _____ _____

Name of participant [printed]   Signature   Date

I, as legal representative, have witnessed the accurate reading of the consent form with the potential participant and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

_____ _____ _____

Name of witness   [printed]   Signature   Date

I, as researcher, have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

_____ _____ _____

Researcher name [printed]   Signature   Date

Study contact details for further information:

Oualid el Margai

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Appendix C.
Interview protocol

Voorafgaand aan het interview:

- Uitnodiging verzonden en geaccepteerd
- Tijd en locatie afgestemd
- Informed consent getekend
- Opname klaarzetten

START

Introductie

Goedemiddag, dank dat u wilt deelnemen aan dit interview. Ik ben Oualid el Margai, masterstudent CME aan de TU Delft en momenteel afstudeerstagiair bij de gemeente Rotterdam. Mijn onderzoek richt zich op hoe waarden worden geïnterpreteerd en afgewogen binnen de circulaire buitenruimte.

Het interview duurt ongeveer 45 minuten en wordt opgenomen, mits u daar toestemming voor geeft. Alles wat u deelt wordt volledig anoniem verwerkt en is niet herleidbaar naar u of uw functie. Deelname is vrijwillig. U mag vragen overslaan of opmerkingen maken als iets onduidelijk is.

Na afloop zal ik de opname gebruiken om een transcriptie te maken, zodat ik uw antwoorden zorgvuldig kan analyseren. Uw input wordt volledig geanonimiseerd verwerkt en de opname wordt direct na transcriberen verwijderd.

Mag ik vragen of u toestemming geeft voor het opnemen van dit gesprek?

START RECORDING

Blok 1: Interpretatie van circulaire buitenruimte en waarde

We beginnen met een aantal verkennende vragen over hoe u aankijkt tegen circulariteit en waarde binnen de circulaire buitenruimte. In de literatuur worden deze begrippen op uiteenlopende manieren geïnterpreteerd. Ik ben benieuwd hoe u dat ervaart in uw eigen werkpraktijk.

1. **Hoe zou u zelf het begrip 'circulaire buitenruimte' omschrijven?**

In dit onderzoek gebruik ik het begrip waarde voor datgene waar belang aan wordt gehecht bij het ontwerpen of realiseren van de circulaire buitenruimte.

2. **Waar hecht u belang aan in de circulaire buitenruimte, vanuit uw rol als [functie van de correspondent]?**

Samenvattend, op een natuurlijke manier toevoegen:

'U geeft dus aan dat u [x, y, z, etc.] belangrijk vindt bij het realiseren van de circulaire buitenruimte.

3. **Zou u zich kunnen vinden in deze samenvatting?**

Dan beschouw ik deze aspecten als waardes die voor u centraal staan in de circulaire buitenruimte.'

Blok 2: Waarde afwegingen in de praktijk

In dit tweede blok wil ik u een aantal vragen stellen over hoe keuzes tussen verschillende waardes worden gemaakt.

4. **Komen die besproken waardes weleens met elkaar in conflict?** *Kunt u hier een kenmerkend voorbeeld van geven?*

5. **Hoe wordt er dan bepaald welke waarde voorrang krijgt?**

6. **Worden zulke keuzes expliciet besproken, of gaan ze vooral impliciet?**

7. **Kunt u een concreet voorbeeld geven van het maken van keuzes en afwegingen tussen de *verschillende soorten waarde*?**

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8. **Zijn er belemmeringen die het maken van keuzes en afwegingen tussen de** *verschillende soorten waarde* **bemoeilijken? Zo ja, welke?**

9. **Ervaart u het proces van het maken van keuzes tussen verschillende soorten waarde op deze expliciete/impliciete manier als een probleem in het realiseren van de circulaire buitenruimte?**

10. **Wat zou volgens u kunnen helpen om dit tot een werkend proces te laten maken?**

11. **Is er nog iets dat u zelf zou willen toevoegen over dit onderwerp?**

Appendix D.
Coding method example

Raw quote from the transcripts

'Ik zie een circulaire buitenruimte ook als middel om met bewoners iets te doen. Bijvoorbeeld reparatie-festivals of repair cafés, waarbij bewoners samenkomen, hun spullen repareren en ondertussen een praatje maken. Circulariteit kan zo een middel zijn om mensen bij elkaar te brengen.'

Translation

'I also see a circular public space as a way to engage with residents. For example, repair festivals or repair cafés where people come together, repair their belongings, and have a chat. Circularity can be a means to bring people together.'

First cycle – structural and descriptive coding

Notes:

- Public space as a place for community activities
- Social interaction through circular practices
- Community building

Value identification:

Social inclusivity
Public participation

Second cycle – Pattern coding

Higher level category:

The value belongs to the social dimension of sustainability

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Appendix E.
Dutch version of the VTS

[See the following page for the illustration of the VTS in Dutch.]

Lessen uit projecten worden meegenomen naar toekomstige projecten

Verfijning van waarden

Verbeterde project start

INPUT

Waarden (Projectspecifiek):

Fysiek omgevingscomfort
Ecologische duurzaamheid
Vermindering van vervuiling
Behoud en herstel van natuurlijke hulpbronnen
Biodiversiteit
Financiële duurzaamheid
Economische haalbaarheid
Economische vitaliteit
Ruimtelijke functionaliteit
Ruimtelijke veiligheid
Ruimtelijke diversiteit
Ruimtelijke toegankelijkheid
Culturele duurzaamheid
Sociaal welzijn
Publiek bewustzijn en perceptie
Gemeenschapsbetrokkenheid
Duurzaamheid
Klimaatregulering
Kwaliteit
Sociale inclusiviteit
Esthetiek
Beschikbaarheid

INPUT

Ambitienota

INPUT

PVE
Prioriteringskader
Besluitendocument

INPUT

Alle projectspecifieke gegevens die tijdens de voorbereiding en uitvoering van het project worden gegenereerd

Initiatie fase

Vertaling van waarden naar brede doelen / ambities

Waarden → Doelen

Ontwerp- & aanbestedingsfase

Doelen → Specifieke en meetbare eisen

Prioriteringskader

Beoordeling van opties

Uitvoeringsfase

Uitvoering van eisen

Vastleggen van afwegingen en besluiten

Beheersen van randvoorwaarden

Evaluatie fase

Vergelijken van de initiële doelen met het gerealiseerde project

Vastleggen van de geleerde lessen uit het project

Bijdragen aan een groeiende kennisbasis binnen de gemeente

OUTPUT

Ambitienota:

Dit document legt de overeengekomen waarden vast en bevat een overzicht van de doelen/ambities die uit deze waarden voortvloeien.

OUTPUT

1. PvE
Het Programma van Eisen, waarin de overeengekomen doelen worden vertaald naar afdwingbare eisen.

2. Prioriteringskader
Een gestructureerde hiërarchie voor het oplossen van afwegingen tussen eisen, en een referentiepunt gedurende de daaropvolgende fasen.

3. Besluitendocument
De beoordeling van ontwerpopties, de onderbouwing van de gemaakte keuzes en de documentatie van hoe randvoorwaarden zoals planning, budget, logistiek en technische haalbaarheid zijn meegenomen.

OUTPUT

Afwegingsregister
Dit document registreert alle wijzigingen, afwegingen en besluiten die tijdens de realisatie van het project worden gemaakt. Elke vermelding legt vast: de locatie, de aard van de wijziging, welk(e) eis of vereiste wordt geraakt, de randvoorwaarde of factor die dit heeft veroorzaakt, de toegepaste mitigerende strategieën, het uiteindelijke besluit, het gevolg en eventuele compenserende maatregelen elders in het project.

OUTPUT

Evaluatienota
Dit document geeft een samenvatting van de mate waarin de doelen zijn bereikt, licht eventuele afwijkingen toe en benadrukt de belangrijkste lessen die meegenomen worden naar de toekomst.

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