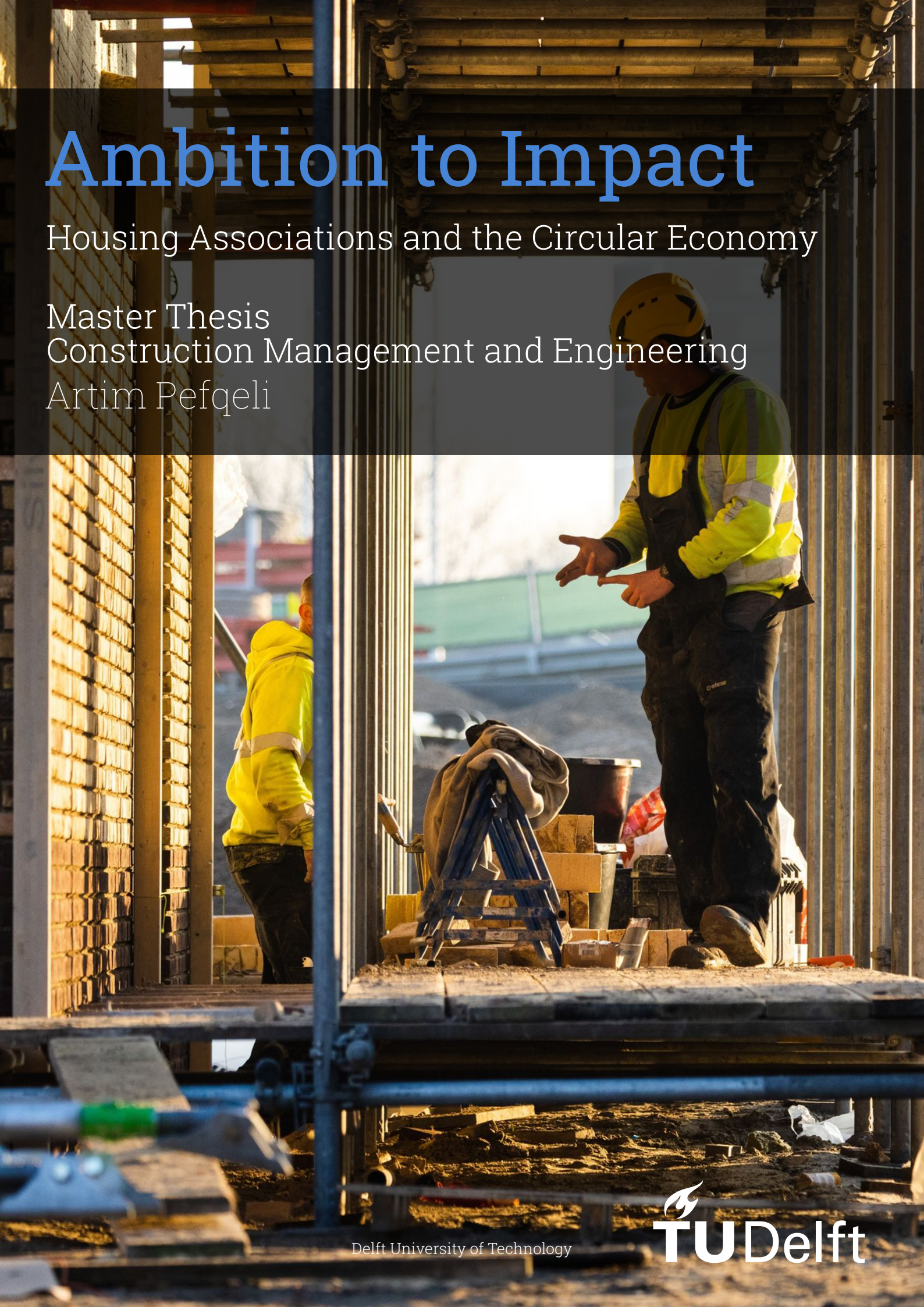
Ambition to Impact

Housing Associations and the Circular Economy

Master Thesis
Construction Management and Engineering

Artim Pefqeli



Delft University of Technology

TU Delft

Ambition to Impact

Housing Associations and the Circular Economy

by

Artim Pefqeli

in partial fulfillment of the requirements for the degree of

Master of Science
in Construction Management and Engineering

at the Delft University of Technology,
to be defended publicly on Thursday, August 21, 2025 at 15:30

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Project Duration:	Dec, 2024 - Aug, 2025
Faculty:	Civil Engineering & Geosciences, Delft

Cover:	Dutch Construction workers working on a newly build house. [ANP] (Modified)
Style:	TU Delft Report Style, with modifications by Daan Zwaneveld & Artim Pefqeli

TU Delft

Preface

Completing this thesis marks the end of an important chapter in my life: my time as a university student. In many ways, it feels like a symbolic farewell to youth. With this final milestone, I officially step out of the student phase and into the next stage of life. It is a moment of relief, but also one of reflection and gratitude.

I first would like to thank my two thesis supervisors, Dr. Ad Straub and Dr. Ir. Erik-Jan Houwing. Writing a thesis did not come naturally to me, and I truly appreciate your critical feedback, guidance, and support throughout this process. Your trust and expertise made all the difference.

Studying at TU Delft has not always been easy for me, the pressure and expectations were often high, but it has also been a place full of opportunity and growth. I am deeply aware of the privilege it has been to study at such a good university. Here, I was taught from brilliant professors, was able to make friends from around the world, discover more about myself, mature, and even meet the love of my life, while doing our homework together.

One of the most formative experiences during my studies was my exchange semester at the Tokyo Institute of Technology in Japan. That period allowed me to experience a completely different academic and cultural environment, and it remains one of the most meaningful memories of my life. I am especially thankful to Dr. Erik-Jan Houwing, whose recommendation letter helped make that opportunity possible.

Finally, I want to thank my parents. They grew up without many of the opportunities I was given, and worked hard to ensure I could reach for anything I aspired to. Their support has been the foundation of everything I've ever achieved.

Now, as this period comes to a close, I look back with pride at what has been a challenging but fun journey. I look forward to whatever comes next, with a degree in hand and a mind full of great memories.

Artim Pefqeli
Delft, August 2025

Summary

This thesis examines how Dutch housing associations can integrate circular economy aims while delivering homes quickly and affordably. It identifies a Capacity–Circularity Gap: the distance between what associations want on circular construction and what they can deliver within current rules, tools, and routines. Two imperatives sit side by side in daily practice. There is pressure for speed, cost control, and volume, and there is the ambition to build for long-term value with lower resource use. The analysis shows that throughput usually weighs heavier, which keeps circular options at the margins of mainstream delivery.

The research combines a context study, a literature review, and a qualitative empirical phase with five semi-structured interviews with practitioners in housing associations and municipalities. Transcripts were thematically analyzed and the findings were validated in an interview with the program manager for Onderhoud en Verbetering and interim sustainability lead at Aedes. The expert validation helped to locate where circular options fall out and which steps are most useful in practice.

Three mechanisms explain how the gap is produced. First, an early financial filter, described by the expert as the horizon gap, keeps longer-term and component-level effects outside selection and funding at the moment of choice. Circular options can then drop out before they build a track record. Second, circular know-how is not yet embedded in routine tools and workflows. Lessons stay in pilots, and perceived risk remains high. Third, procurement settings and the way risk and liability are handled pull decisions back to familiar solutions under delivery pressure, especially when evidence for reused and bio-based parts is not standardized.

From these results, the thesis proposes three connected pathways. Developing Circular Expertise focuses on short learning cycles, shared checklists, and peer exchange so lessons move from pilots into routine work. Redesigning Business Model brings longer-term effects into go or no-go and award decisions through a concise circular section with a small, stable set of performance criteria and expected evidence. Building Market Supply aligns criteria and demand across clients and fits risk allocation and documentation to reused and biobased components, which lowers supplier uncertainty and supports reliable delivery at volume. The expert validation confirmed the logic and the order: capability before criteria, criteria before wider market moves.

Sector initiatives can host these steps. Netwerk Conceptueel Bouwen supports learning and specification. De Woonstandaard offers comparable baselines that can carry clear circular criteria. De Bouwstroom aggregates demand and timelines so suppliers can plan and invest. Used together, these initiatives help turn ambition into normal practice without slowing delivery.

The contribution of this work is to translate a broad tension into operational guidance for Dutch housing associations. It names and locates the horizon gap, shows the decision points where circular value is filtered out, and sets out practical steps that fit current mandates. If applied now, these steps can narrow the distance between want and can and help the sector keep a credible path to the national goal of a fully circular economy by 2050, while continuing to build the homes the Netherlands urgently needs.

Contents

List of Figures

List of Tables

Nomenclature

Abbreviations

Abbreviation	Definition
BIM	Building Information Modeling
CDW	Construction and Demolition Waste
CE	Circular Eonomy
CLSCs	Closed-Loop Supply Chains
DfA	Design for Adaptability
DfD	Design for Disassembly
DfMA	Design for Manufacture and Assembly
EU	European Union
IoT	Internet of Things
VROM	Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer
WSW	Waarborgfonds Sociale Woningbouw

1

Introduction

The built environment is shaped by cycles of crisis and reconstruction, with each episode prompting urgent societal responses that often favor short-term recovery over long-term sustainability. This tension has re-emerged in the Netherlands, where an acute housing shortage and ambitious environmental goals are challenging established approaches to housing delivery. Dutch housing associations find themselves at the center of this policy landscape, navigating competing demands to provide affordable housing rapidly while simultaneously advancing the transition to a circular economy. This chapter situates the research problem within this broader context, outlining the historical and contemporary drivers of housing policy, the inherent value conflicts faced by housing associations, and the research approach adopted to investigate these issues. Through this lens, the chapter introduces the background, problem statement, objectives, research questions, and methodological framework that structure the thesis.

1.1. Background Information

Throughout history, built environments have often faced destruction due to war, natural disasters, or economic crises. In the aftermath of such events, the immediate societal focus typically shifts to rapid reconstruction, prioritizing urgent shelter and infrastructure over long-term considerations such as durability, environmental impact, or innovation (Vale et al., 2005). While such reactive rebuilding efforts are essential for societal stability, they tend to diminish sustainability ambitions in favor of short-term delivery goals (Macaskill & Guthrie, 2014).

A similar dynamic is unfolding today across many European countries, where governments face compounding pressures from housing shortages, climate change, and urbanization (ECSO, 2019). The Dutch context is particularly illustrative. The Netherlands is currently experiencing a severe housing crisis, with an estimated shortage of nearly 400,000 homes and projections of continued growth in demand over the coming decade (ABF Research, 2024a).

In response, the Dutch government has set a national goal of delivering 900,000 new dwellings by 2030 (Rijksoverheid, 2023). However, it relies on decentralized implementation: municipalities and housing associations are tasked with execution, while the state primarily sets direction. This delegation means that the most immediate pressure is felt at the local level, especially by municipalities responsible for housing asylum seekers, labor migrants, and other urgent target groups. These municipalities, in turn, enter into performance agreements (prestatieafspraken) with housing associations, who must realize housing ambitions within tight regulatory, financial, and technical constraints.

At the same time, the Dutch government has committed to achieving a fully circular economy by 2050, a goal that implies transformative changes in how buildings are designed, constructed, operated, and decommissioned (Government of the Netherlands, 2023a). Circular construction principles, such as material reuse, modularity, and life-cycle design are seen as key to reducing environmental impact and construction waste (Pearce & Turner, 1990). Yet, the systemic adoption of circular strategies often requires time, experimentation, and organizational capacity (Osei-Tutu et al., 2022), resources that

local actors frequently lack.

This creates a core tension in the current housing policy landscape: the need to build quickly and at scale to address acute shortages conflicts with the slower, more complex path required to implement circular and sustainable building practices. These pressures reflect a broader clash between product values (e.g. circularity, energy efficiency), performance values (e.g. delivery time, cost-efficiency), and process values (e.g. inclusive governance, public collaboration), as recognized in public value theory (Kuitert et al., 2022). Housing associations must navigate these competing expectations, often without institutional support, capacity, or mandate to meaningfully align them.

1.2. Problem Statement

As outlined in the background, crisis conditions frequently shift attention towards short-term solutions, often marginalizing longer-term goals. The current housing shortage in the Netherlands exemplifies such a crisis (NOS, 2024b). Dutch housing associations face intense pressure to rapidly increase housing supply and meet affordability targets, reinforcing their reliance on established linear construction methods prioritizing efficiency and cost-effectiveness (Ministerie van Volkshuisvesting en Ruimtelijke Ordening, 2025).

At the same time, housing associations are expected to support ambitious national goals such as achieving a fully circular economy by 2050. Circular economy strategies, such as material reuse, modularity, and bio-based construction, promise significant environmental benefits but demand higher initial investments, extended project timelines, and intensified stakeholder coordination (Government of the Netherlands, 2024c; Osei-Tutu et al., 2022).

This situation positions housing associations within a structurally conflicting value landscape, characterized by competing performance values (efficiency, speed), product values (sustainability, innovation), and process values (transparency, participation) (Kuitert et al., 2018, 2022). Navigating this complexity is particularly challenging given housing associations' limited financial resources and organizational capacity. Without clear strategies to manage these competing public values, housing associations risk prioritizing short-term outputs at the expense of long-term societal and environmental goals, raising questions about how they can effectively balance and secure these conflicting interests.

1.3. Research Objective

The objective of this research is to explore how Dutch housing associations can effectively balance and secure competing public values in their construction processes, specifically addressing the tension between rapid housing delivery (performance values) and circular economy integration (product values). This study investigates the barriers housing associations face when aligning short-term volume demands with long-term sustainability ambitions. It also identifies enabling conditions and strategies that support housing associations in negotiating these value conflicts, thereby offering practical insights into achieving a balanced approach to housing production that meets both immediate social needs and environmental goals.

1.4. Research Questions

The central research question addressed in this thesis is:

How can Dutch housing associations, while urgently expanding their housing stock to address immediate shortages, effectively integrate circular economy principles to ensure long-term sustainability?

This research question is divided into five sub-questions:

SQ1. *What external and internal conditions shape the operating environment of Dutch Housing Associations?*

SQ2. *According to the academic literature, what concepts, strategies, barriers, and enablers govern a transition to circular construction?*

SQ3. *Which barriers and enablers are most relevant to Dutch housing associations?*

SQ4. *How do Dutch housing associations navigate the tension between rapid housing delivery and circular construction?*

SQ5. *What strategies can help housing associations overcome circularity barriers?*

1.5. Research Design

This research employs a qualitative methodology structured into three distinct phases. This design facilitates a systematic progression from establishing a theoretical foundation to conducting an empirical investigation, and ultimately to synthesizing the findings into actionable conclusions. Each phase addresses specific sub-questions, integrating the outcomes of the preceding phase to construct a comprehensive answer to the main research question.

1.5.1. Phase 1: Theoretical Foundation

This initial phase establishes the theoretical and contextual groundwork for the research, addressing Sub-question 1 and Sub-question 2:

- **SQ1.** What external and internal conditions shape the operating environment of Dutch housing associations?
- **SQ2.** According to the academic literature, what concepts, strategies, barriers, and enablers govern a transition to circular construction?

To answer these questions, this phase begins with a context analysis to map the key policy, economic, and institutional conditions that define the Dutch housing sector. This includes an examination of the national housing shortage, affordability policies, and the circular economy target for 2050, utilizing public data, government reports, and sector publications. Subsequently, a comprehensive literature review is undertaken to summarize academic research on circular construction. The review concentrates on core definitions, conceptual frameworks, practical strategies, and the most frequently cited barriers and enablers. The literature search employs key academic databases (e.g., Google Scholar, ScienceDirect, Scopus) with keywords such as ”circular economy,” ”construction,” ”housing associations,” ”barriers,” and ”enablers.”

1.5.2. Phase 2: Empirical Investigation and Strategy Development

The second phase transitions from theory to practice through the collection and analysis of empirical data. This phase is dedicated to addressing Sub-questions 3, 4, and 5:

- **SQ3.** Which barriers and enablers are most relevant to Dutch housing associations?
- **SQ4.** How do Dutch housing associations navigate the tension between rapid housing delivery and circular construction?
- **SQ5.** What strategies can help housing associations overcome circularity barriers?

To answer these questions, five semi-structured interviews were conducted with experts from housing associations and municipalities. The interview protocol focused on key challenges (e.g., policy, finance, mindset), organizational routines, and the interplay between circular ambitions and short-term housing targets. All interviews were transcribed and thematically analyzed to identify the most salient barriers and enablers in practice and to understand how organizations manage the tension between performance and sustainability. Drawing upon these insights, three strategic pathways were formulated to support housing associations in embedding circular principles. To ensure their practical relevance, these pathways were subsequently refined through an expert validation interview with a sustainability program manager at Aedes, the national umbrella organization for housing associations.

1.5.3. Phase 3: Discussion, and Conclusions

The third phase brings the study together and answers the main research question. It synthesizes insights from the context study, literature review, and interviews into a clear account of how the Capacity–Circularity Gap arises and how it can be narrowed in practice. This phase translates findings into implications for Dutch housing associations and the wider sector, discusses how existing initiatives can support implementation at pace and scale, and formulates concrete recommendations. It also reflects on the study’s contribution and outlines directions for future research.

I

Phase

2

Context Study

This chapter provides the contextual foundation for the research and addresses the first sub-question:

- **Sub-question 1** – What external and internal conditions shape the operating environment of Dutch housing associations?

To answer this question, the chapter maps the political, economic, environmental, and institutional context within which housing associations operate. The aim is to clarify how external forces, ranging from housing policy and climate targets to regulatory frameworks and financial rules, create both opportunities and constraints for circular construction.

The chapter is structured into four sections. Section 2.1 examines the current housing crisis in the Netherlands, the causes behind it, and the national strategies aimed at rapidly increasing housing supply. Section 2.2 focuses on long-term sustainability goals, including the national ambition for a carbon-neutral, circular economy by 2050 and its implications for the construction sector. Section 2.3 outlines the mandate, development, and legal framework of Dutch housing associations, emphasizing their dual role as social landlords and real-estate developers. Section 2.4 then brings these elements together in a conceptual framework that visualizes how external drivers and internal constraints interact to shape project-level decision-making.

2.1. Short-Term Goal: Housing Goals in the Netherlands

This section examines the urgent need for housing in the Netherlands, focusing on the causes of the housing crisis, government measures to accelerate construction, and the challenges of meeting demand. It explores factors such as population growth, policy decisions, and environmental regulations that have contributed to the shortage. Additionally, it discusses how policies like financial incentives and planning reforms aim to speed up construction while balancing affordability and quality. Understanding these aspects is essential for assessing the effectiveness of current strategies in addressing the housing crisis.

2.1.1. Housing Crisis in The Netherlands

At the moment, the Netherlands is facing a severe housing shortage (Henley, 2024). In 2024, the housing shortage in the Netherlands rose to 401,000 home (ABF Research, 2024b). Meanwhile the Dutch Ministry of Housing, Spatial Planning and the Environment (VROM) (Dutch: *Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer*), estimates that the total demand for additional homes in 2024 is 451.000 homes (BZK, 2024a). This housing shortage creates long waiting lists for social houses (NOS, 2021b), for which some people need to wait more than 10 years for. In addition, it drives up house prices so much that many individuals and families are unable to buy their first home (BZK, 2024b).

There are several factors that brought the Netherlands into this situation. In 2008, the financial crisis forced many construction projects to be stopped or delayed (Nistorescu & Ploscaru, 2010). Further-

more, housing associations were pushed by the government's policies to sell their homes that exceeded the social rental standards, while also being subjected to pay additional tax on their rental income (Dutch: verhuurderheffing) (Stam, 2021). This and other additional taxes and the government's aim of housing associations becoming more like regular companies, caused these associations to scale back on new construction and sell off property (Veenstra et al., 2016). As a result, new build numbers dropped and the amount of social houses decreased.

In the meanwhile, the housing market changed substantially after the 2008 financial crisis. While in 2015 the main problem was that many homes had a lower market price than their mortgage, the years that followed saw housing prices increase again (see figure 2.1). Meanwhile, population growth and the changing of household compositions, limited building land and long permit processes slowed down new construction projects (CBS, 2019). In more recent times, an additional problem appeared, environmental regulations. Specifically related to nitrogen emissions, resulted in a so-called Nitrogen Crisis (Dutch: Stikstof Crisis), further delaying and complicating housing projects (Kamphuis, 2023). Lastly, The construction sector is also faces labor and materials shortages (CBS, 2023).

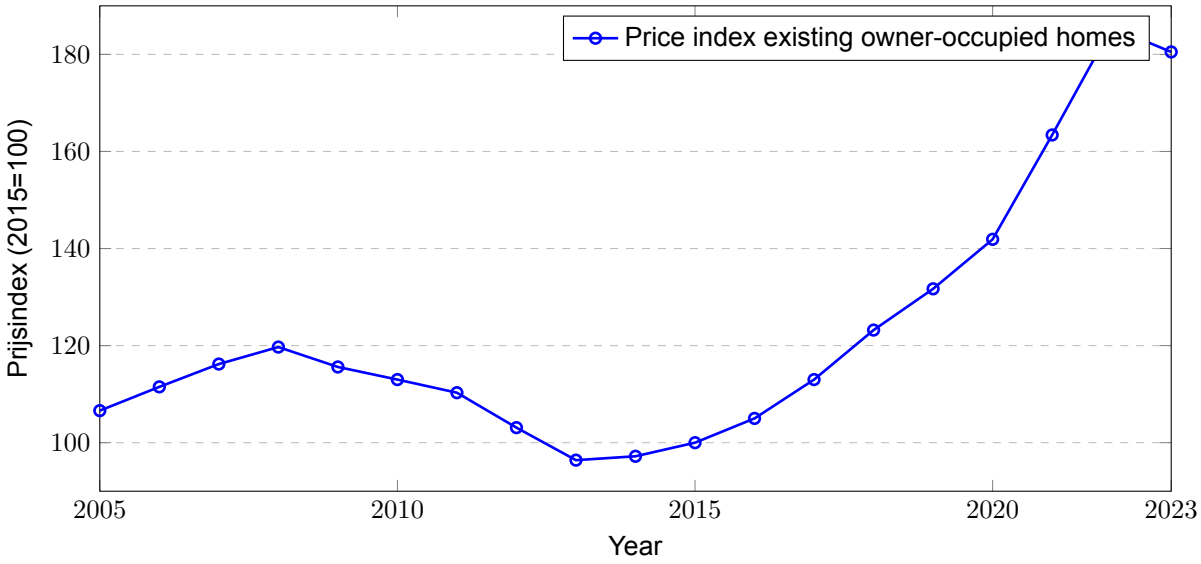

Figure 2.1: Price index of existing owner-occupied homes per year (Centraal Bureau voor de Statistiek, 2024)

To help mitigate the shortage, the Dutch government and industry stakeholders plan to build 900,000 new homes by 2030 (Rijksoverheid, 2023). However, this goal appears challenging. For instance, 2020 saw fewer housing completions than the previous year, and projections by the Economic Institute of Construction (EIB) indicate that annual output may lag behind government targets (EIB, 2022). This urgent push to expand housing supply also faces tensions involving sustainability, affordability, and quality. According to Hans Meurs (a Dutch developer's director cited in AD), scarce and costly labor, higher material prices, and sustainability requirements make it difficult to deliver homes both rapidly and cost-effectively (AD Wonen, 2024).

The then de-missionary Minister De Jonge has acknowledged these disappointing figures, stressing that the number of newly built homes must increase at a faster rate than the population (NOS, 2024b). He called for "more speed and more coordination, and more affordable housing" to catch up with the existing shortage (NOS, 2024b). Only after 2030 (see figure 2.2, the housing shortage is expected to gradually decline, potentially reaching 205,000 in 2038, yet the research bureau warns that population forecasts, and thus future housing demands remain uncertain, partly due to unpredictable migration (ABF Research, 2024a).

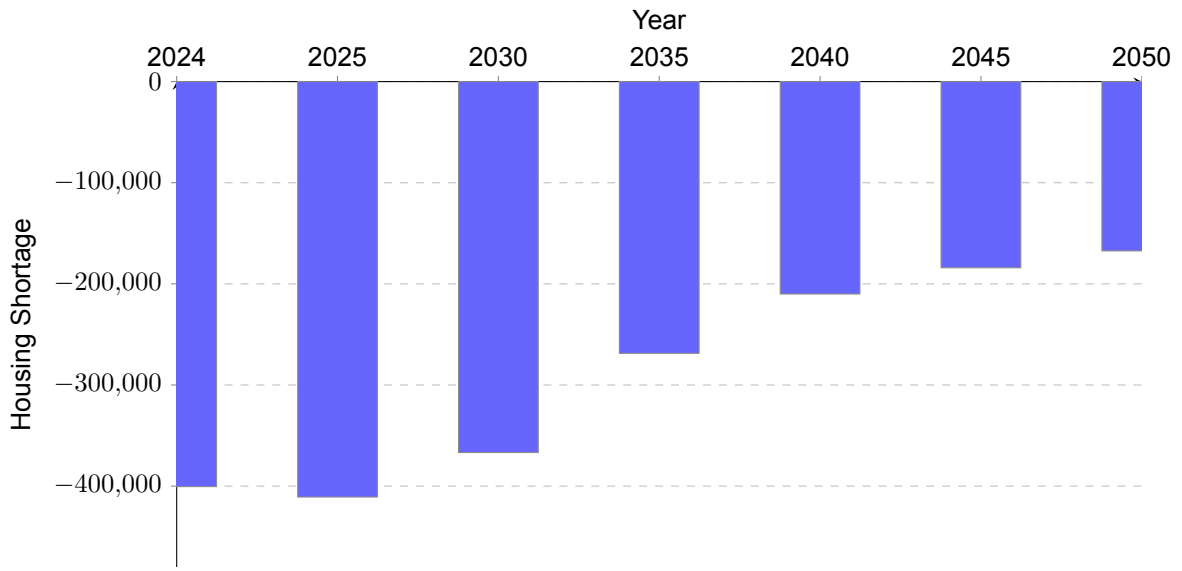

Figure 2.2: Housing shortage from 2024 to 2050 (ABF Research, 2024a)

2.1.2. Policy Measures and Their Implications

In response to the housing crisis, the Dutch government and housing sector organizations have launched several initiatives, including ”Woonakkoorden” (housing accords) (NOS, 2021a). These agreements support collaboration among major stakeholders, aiming to build one million homes by 2030. The main idea is to build as many homes as possible to match supply with demand. However, implementing this plan has been challenging, given the nature of the problem (NOS, 2024a).

Initially, measures introduced during and after the financial crisis imposed significant financial obligations on housing associations through a compulsory fee on their rental revenue (Aedes, 2024c). This measure was designed to enhance effectiveness and reduce what was seen as market-distorting actions by the associations. However, it unintentionally restricted their capacity to invest in new housing, renovate current properties, and sustain affordability (Aedes, 2024c). While this fee has been abolished, the harm caused to the social housing development over the last decade remains.

To reach this objective, the government implemented the so called ”Woningbouwimpuls” (English: Housing Construction Impulse) (Volkshuisvesting, 2024). This plan provides financial support to municipalities across the Netherlands to help them develop land and infrastructure for extra housing. With this incentive, the government aims to accelerate housing projects and construction.

The Dutch government has also introduced the so called ”Woondeals” (Dutch: Housing Deals) (Ministry of Housing and Spatial Planning, 2024b). This is an agreement between national, provincial and municipal authorities and often also extends to private developers and housing associations and sets clear targets for the quantity, type, and affordability of new housing. By adapting solutions to local needs, the so called ”Woondeals” hope to facilitate a more efficient and context-sensitive response to the housing crisis (Ministry of Housing and Spatial Planning, 2024b). Furthermore, they help insure that both high-demand urban centers and more outer laying regions receive appropriate and balanced attention.

In addition to these financial incentives and collaboration agreements, the Dutch government is reforming fiscal and regulatory rules to improve the investment climate in the Netherlands. For instance, the Dutch government lowered transfer taxes for home buyers (Agency, 2024). Moreover, revisions to planning and environmental regulations, including the implementation of the Environment Act (Dutch: Omgevingswet), aim to simplify and accelerate the permitting process (of the Netherlands, 2024). Streamlining and simplifying procedures and shortening project timelines, reduce costs and ultimately help contribute to higher construction volumes.

In addition, the government signed the National Performance Agreements (Dutch: Nationale Prestatie

Afspraken, NPA) with housing corporations, municipalities and tenant organizations (Ministry of Housing and Spatial Planning, 2024a). By renegotiating these agreements, policymakers aim to ensure that development goals, affordability measures and sustainability standards are collectively achieved. In 2025, the government aims to simply the rent benefit system (Dutch: huurtoeslag) and introducing fairer rental frameworks, such as clarifying service charge regulations (Rijksoverheid, 2024). These measures also aim to improve transparency and accountability, promoting a fairer environment for both tenants and landlords.

2.2. Long-Term Goal: A Sustainable Netherlands

This section explores the Netherlands' goal of achieving a carbon-neutral and circular economy by 2050, focusing on the role of the construction sector in meeting sustainability targets. It examines key policies, such as climate agreements and energy efficiency regulations, that drive the transition toward sustainable building practices. Additionally, it discusses the definition of sustainable construction, the challenges of implementation, and the impact on housing development. Understanding these factors is crucial for aligning long-term environmental goals with the need for large-scale housing production.

2.2.1. Carbon-neutral and Circular Economy by 2050

Global awareness of the climate crisis has intensified since the adoption of the 2015 Paris Agreement, in which countries committed to limiting global temperature rise to well below 2°C, with a preferred target of 1.5°C (UNFCCC, 2015). Subsequent international climate conferences, including COP26 and the Glasgow Climate Pact, have reaffirmed the urgency of cutting greenhouse gas emissions (UNFCCC, 2021). The construction industry has come under particular scrutiny, given its substantial environmental footprint: global CO_2 emissions exceed 10 gigatonnes annually (IEA, 2020b), and the building sector is responsible for approximately 39% of these emissions (Abergel et al., 2019). Furthermore, this sector accounts for nearly half (46%) of all waste generated across the European Union (Gálvez-Martos et al., 2018).

At the European level, key policy frameworks such as the 2010 Energy Performance of Buildings Directive (European Union, 2010) and the 2012 Energy Efficiency Directive (European Union, 2012) have emphasized the reduction of energy demand in buildings. These ambitions were further reinforced by the Paris Agreement (United Nations, 2015), which spurred member states to enact more ambitious carbon reduction plans (PBL, 2016). In the Netherlands, this has led to the formulation of the Climate Agreement, which aims to cut greenhouse gas emissions by 49% by the year 2030, compared to 1990 levels (Klimaatakkoord, 2018). New national policies, such as the updated climate strategy (National Climate Agreement, 2019) and the introduction of revised energy performance standards for homes (NEN, 2020), underscore the continued emphasis on sustainability within the Dutch building sector.

Yet, focusing solely on energy efficiency does not fully capture the sector's environmental burden. Construction and the broader built environment are major resource consumers, contributing around 9% to the EU's gross domestic product (European Commission, 2016) and relying heavily on virgin materials (Giljum et al., 2016). In response, the Netherlands has embraced the circular economy model, which aims to reduce resource input and waste output by fostering closed-loop systems (Bocken et al., 2016), eliminating pollution (Ellen MacArthur Foundation, 2020), and promoting regenerative design. This development can be seen in the Circular Economy Action Plan which is part of European policy (Eberhardt et al., 2020). It has prompted several countries, including the Netherlands, to adopt national strategies intended to speed up the transition process (Government of the Netherlands, 2023a; Marino & Pariso, 2020).

In 2023, the Dutch government reaffirmed its dedication to realizing a fully circular economy by 2050 (Government of the Netherlands, 2023a). A new National Circular Economy Program (2023–2030) outlines four main routes toward reducing raw material use, substituting traditional resources with sustainable or bio-based alternatives, prolonging the lifespan of existing products with recycling materials at the highest possible value. In a construction context, this means not only reducing operational energy usage but also prioritizing modular building, reuse of demolition waste, and design for disassembly to prolong a structure's life cycle and minimize landfill (Government of the Netherlands, 2023a).

The Dutch government's focus on circular construction aligns with broader European directives, but

it also responds to the local reality that older dwellings demand high investment levels for retrofitting (Filippidou et al., 2017). Aedes, which represents Dutch housing associations at the national level, has set the goal of reaching a CO_2-neutral social housing stock by 2050, aligning its objectives with broader national and international targets (Aedes, 2024b). Yet, achieving the combination of carbon neutrality and circularity requires significant financial and technical efforts, from insulating and renovating old properties to ensuring the reuse and recycling of materials. Through these endeavors, the construction sector can move beyond mere energy efficiency and address the full environmental footprint of buildings, from resource extraction to end-of-life disposal.

2.2.2. Sustainable Building in the Netherlands

The Dutch government combines ambitious housing targets with strong sustainability goals, requiring innovative solutions to increase the number of new homes while reducing environmental impacts. The Ministry of Volkshuisvesting en Ruimtelijke Ordening intends to build a large volume of future-proof dwellings by 2030 and places sustainability requirements on both construction and use phases. Two major strategies are (Government of the Netherlands, 2024c):

Circulair bouwen (Circular Building), which emphasizes material reuse and biobased construction, using renewable materials like flax, straw, or hemp. This approach lowers waste and conserves resources.

Industrieel bouwen (Industrial Building), involving factory-produced housing components assembled on-site to reduce CO_2 and nitrogen emissions. Variants like Industrieel, Flexibel en Demontabel (IFD) enable flexible layouts and simplified disassembly, supporting circular principles in the long term.

Raising annual housing production is essential for tackling the ongoing shortage, yet achieving this increase in a sustainable manner poses challenges (Government of the Netherlands, 2021). To address both speed and environmental goals, many stakeholders focus on conceptual and industrial building methods, which can shorten project timelines and reduce emissions while maintaining quality. In 2020, approximately 10,000 homes were already built using conceptual methods, and the sector anticipates a significant capacity for factory-produced units in the coming years (Government of the Netherlands, 2021).

Beyond immediate housing needs, the Netherlands aims for a fully circular construction sector by 2050, requiring new design strategies, business models, and material choices (Rijksdienst voor Ondernemend Nederland (RVO), 2024). Initiatives like City Deal Circulair en Conceptueel Bouwen (Government of the Netherlands, 2024a) and the Nationale Aanpak Biobased Bouwen (NABB) (Government of the Netherlands, 2024b) encourage closer collaboration between government, industry, and knowledge institutions. Under the NABB, four ministries (VRO, LNV, EZK, and I&W) plan to significantly increase biobased material usage in new and existing buildings by 2030 (Government of the Netherlands, 2024b). Policy tools, such as strengthening environmental performance regulations, financial incentives for low-impact materials, and supporting biobased supply chains, are designed to spur market growth (Government of the Netherlands, 2023b).

Although various circular and industrial initiatives are underway, scaling up remains a hurdle. Current activities are often too small in scope, and demand for biobased materials is inconsistent (Government of the Netherlands, 2023b). Building developers are reluctant to invest without predictable returns or clear policy signals. At the same time, the processing capacity for renewable materials and the coordination between agriculture, manufacturing, and construction lag behind ambitions. These gaps show a need for stronger market incentives, more robust regulatory frameworks, and shared investment in innovation.

2.3. Dutch Housing Associations

Dutch housing associations play a central role in addressing both the urgent need for affordable housing and the national sustainability ambitions. As semi-public organizations, they are responsible for a significant share of the Dutch housing stock and are key actors in the delivery of social and mid-market rental housing. Their legal obligations, financial structures, and operational strategies are heavily influenced by national policies and societal expectations.

This section presents an overview of the historical development of Dutch housing associations, their core objectives under current legislation, and their evolving role in the real estate market. It also examines how sustainability targets are increasingly integrated into their activities. Understanding the institutional framework and operational constraints of housing associations is essential to explain how external pressures shape their ability to respond to both short-term and long-term demands.

2.3.1. History

Housing associations (in Dutch: *woningcorporaties*) in the Netherlands have their origins in private initiatives. Following the introduction of the *Woningwet* (Housing Act) in 1901, these associations could develop housing for the public good with government support (Boelhouwer et al., 2014; Snuverink, 2006). After the Second World War, the Netherlands required a large number of new homes, and housing associations took over municipal construction tasks. Over time, however, these associations increasingly pursued higher-end rentals and home-ownership products (Rijksoverheid, 2025), prompting concerns that they were becoming more like real-estate companies detached from their low-income target group (Boelhouwer et al., 2014). In the 1990s, the Dutch government reduced direct financial support for housing associations (Hoekstra, 2017), shifting responsibility for project financing to the Waarborgfonds Sociale Woningbouw (WSW) (Boelhouwer, 2011). This marked a transition from state-funded social housing to a market-based supervisory model, formalized through policies such as the Grossing and Balancing Agreement of 1995 and later reinforced by the Housing Act of 2015 (Hoekstra, 2017). The most recent legislation re-emphasizes the associations' core mandate: providing affordable rental housing for households with low incomes (Rijksoverheid, 2025). This renewed focus on social responsibility directly informs the key objectives that define the role of housing associations today.

2.3.2. Objectives

The activities of Dutch housing associations are governed by the Woningwet (Rijksoverheid, 2025), which sets out their primary duties related to delivering affordable and good-quality housing. These objectives are further reinforced through prestatieafspraken (performance agreements) between housing associations (Ministerie van Volkshuisvesting en Ruimtelijke Ordening, 2025), municipalities, and tenant organizations, ensuring that national housing policies are effectively implemented at the local level. The objectives of housing associations are not only centered on affordability but also encompass sustainability, housing quality, and tenant participation.

The Woningwet establishes clear directives on how housing associations should function to serve public interest (Rijksoverheid, 2025). It mandates that a significant proportion of rental housing must remain accessible to low-income households and that commercial activities of housing associations do not interfere with their primary social mission. Furthermore, the Nationale Prestatieafspraken 2025-2035 expand on these objectives by integrating sustainability goals, affordability measures, and quality improvements in housing stock (Ministerie van Volkshuisvesting en Ruimtelijke Ordening, 2025).

Table 2.1 presents an overview of the main objectives of Dutch housing associations as outlined by the Woningwet. These objectives ensure that housing associations contribute not only to the provision of affordable rental homes but also to broader societal goals, such as environmental sustainability, tenant rights, and financial transparency.

Table 2.1: Objectives of Housing Associations under the Woningwet (Rijksoverheid, 2025)

Objective	Description
Affordable Housing Provision	Housing associations must ensure access to affordable rental homes for low-income households. A minimum of 80% of social rental housing is required to be allocated to households whose income falls below a defined threshold.
Ensuring Housing Availability	Housing associations contribute to housing supply through the construction of new social rental homes to meet demand while maintaining affordability.
Affordability and Rent Regulation	Rent levels must remain affordable, with policies supporting rent reductions for low-income tenants and measures to encourage efficient use of housing stock.
Sustainability and Energy Efficiency	Housing associations are expected to invest in sustainability measures, including energy efficiency improvements, circular construction, and sustainable heating technologies, including district heating systems and heat pumps.
Tenant Participation and Influence	Housing associations must involve tenant organizations in decision-making, ensuring tenant rights and interests are represented in policy formation and governance.
Quality and Livability	Investments in housing maintenance, renovations, and neighborhood improvement projects to ensure housing remains in good condition and supports social cohesion.

The role of housing associations extends beyond simply providing shelter; they play an important role in maintaining housing affordability, improving sustainability, and fostering social well-being. These objectives are not static but evolve over time, particularly with the Nationale Prestatieafspraken, which are reviewed periodically to ensure alignment with emerging housing challenges and national policy changes (Ministerie van Volkshuisvesting en Ruimtelijke Ordening, 2025).

2.3.3. Development

For Dutch housing associations, real estate has a dual meaning. While their primary objective remains providing social housing, they must also ensure financial sustainability (Gruis, 2010). This balance between social responsibility and financial viability shapes their real estate strategies. On one side, housing associations are independent organizations with a public task (Gruis, 2010), aiming to provide affordable housing to those in need (Vark, 2016). While aspiring this objective must also remain financially stable to maintain and develop their stock, although economic fluctuations can limit their ability to invest in new construction (Gruis & van der Kuij, 2012). On the other side, associations can generate income through real estate development, strengthening their financial position while continuing to pursue social objectives (Van der Kuij, 2013).

As previously mentioned, housing associations were initially under strict government oversight, but market-oriented reforms in the 1990s granted them greater autonomy. With fewer subsidies, they became increasingly responsible for funding their own investments, leading some to adopt portfolio management strategies similar to commercial real estate firms (Jong, 2007). This shift led some to adopt principles akin to portfolio or fund management (Klieverik, 2006). They must select which types of properties to invest in and establish return requirements, yet they differ from purely commercial investors in continuing to seek a social return.

In practice, housing associations are among the few entities that undertake most real estate chain tasks (A. L. Vlak, 2008), earning about 95% of their revenue from real estate (A. Vlak, 2010). Consequently, they act as both social landlords and real estate developers, balancing financial viability with the mandate to supply affordable homes. Recently, they have ramped up new construction: in the first half of 2023, roughly 6.3 thousand homes were completed, followed by 8.1 thousand in the second half,

and then 8.2 thousand in the first half of 2024 (CBS, 2024). Over the same period, the total number of newly built homes declined to 32.7 thousand, increasing the associations' market share to 25% - up from 18% and 20% in the previous periods (see figure 2.3 (CBS, 2024). This trend highlights their growing importance in addressing urgent housing demands and shaping the broader new-build sector.

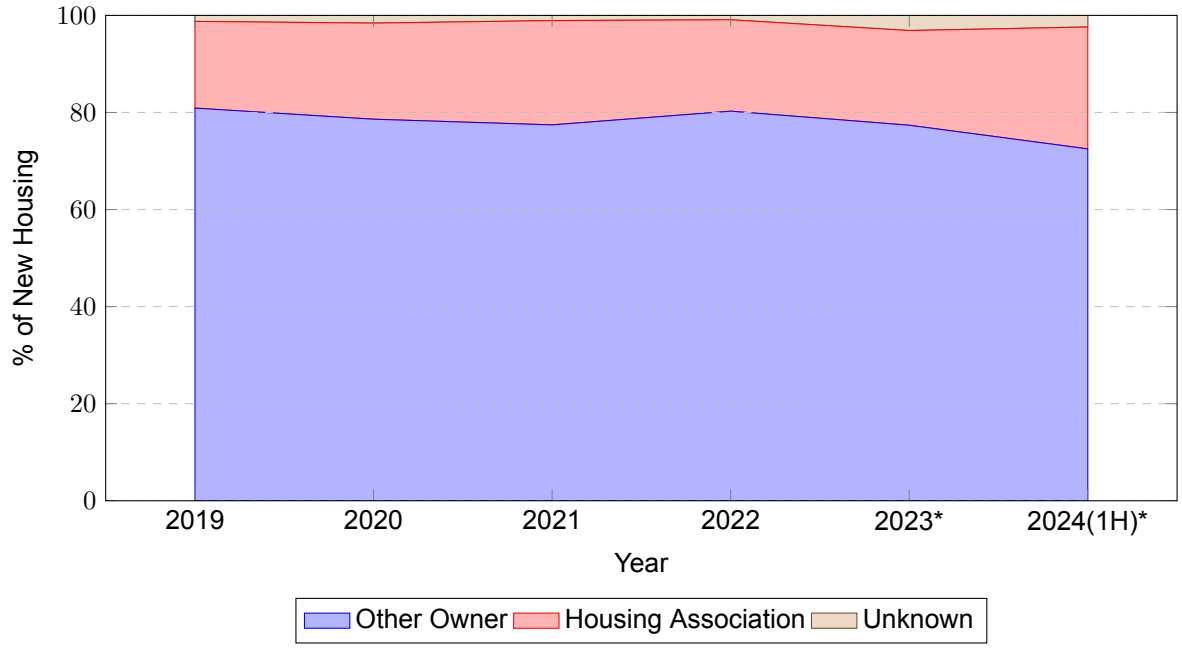

Figure 2.3: Completed new-build homes by ownership (2019–2024) (CBS, 2024).

2.3.4. Sustainability

As housing associations expand their role in real estate development, they face increasing pressure to address environmental concerns. Sustainability has become a key component of their long-term strategies, partly in response to national policy ambitions such as previously mentioned Klimaatakkoord. At the same time, many housing associations have expressed a desire to contribute actively to climate goals by adopting circular and low-carbon construction practices (Aedes, 2025). Housing associations in the Netherlands are currently making large-scale investments to reduce CO_2 emissions and improve energy performance. Recent benchmarks show they have spent up to 10.5 billion euros in a single year on maintenance, energy-efficiency upgrades, and other decarbonization measures (Aedes, 2024a; Duurzaam Ondernemen, 2025). Much of this funding targets higher energy labels, with a growing share of homes rated A or better. Some associations are also experimenting with wood-based construction to lower both emissions and building costs, though such projects still represent a small slice of overall new builds (Aedes, 2024a).

To streamline these upgrades, many housing associations are moving beyond single-project methods and adopting program-based collaborations with construction partners (Meijer & Straub, 2022). They use the same teams repeatedly, embedding process improvements in broader asset management to shorten renovation timelines and lower costs. These measures focus on reducing energy demand, through strategies like improved insulation and efficient heating systems, while also involving residents in environmentally friendly practices and exploring renewable or low-carbon solutions such as solar PV and district heating (Aedes, 2025). Crucially, associations remain committed to affordability, ensuring that rent or fee increases are balanced by the energy-bill savings tenants can achieve.

Housing associations are key actors in meeting Dutch climate goals, as housing accounts for a significant share of national CO_2 emissions. Their influence on the energy transition is determined by a combination of top-down policy and a growing internal conviction to operate more sustainably. For example, the Nationale Prestatieafspraken (National Performance Agreements) require municipalities to finalize gas-free transition plans for 450,000 rental homes by 2027, with a deadline of 2034 for implementation. These measures aim to balance decarbonization with affordability, ensuring that energy

efficiency upgrades do not disproportionately increase housing costs. This demands close cooperation among housing associations, local governments, and net operators to decide whether they should transition to fully electric systems, hybrid heat pumps, or district heating.

2.4. Conceptual Framework

This section establishes the conceptual framework that guides this thesis. It presents a structured narrative to clarify the central problem faced by Dutch housing associations: the systemic tension between the urgent pressure to deliver large volumes of affordable housing and the emerging ambition to contribute to a circular economy. The framework builds on the insights from the context analysis and is visually summarized in Figure 2.4.

2.4.1. Conflicting Imperatives

Dutch housing associations are caught between two structurally misaligned imperatives. The first is a binding Volume Imperative - a non-negotiable mandate to help solve the national housing crisis. By 2024, the shortage exceeded 400,000 homes, prompting government targets to build 900,000 dwellings by 2030. These targets are reinforced through performance agreements and regional woondeals that impose clear obligations on housing associations. The Volume Imperative prioritizes output: speed, cost-efficiency, and volume.

In parallel, a softer Circularity Imperative reflects national ambitions to achieve a fully circular economy by 2050. This ambition is promoted through strategies like the National Circular Economy Program and sectoral initiatives. Many housing associations express a desire to contribute to this long-term vision, but without formal enforcement or equivalent urgency, circularity remains a strategic ”want” rather than an operational requirement.

The conceptual framework (Figure 2.4) places housing associations at the center of these dual pressures. While both imperatives influence decision-making, the structural conditions under which associations operate often align more readily with the performance logic embedded in the Volume Imperative.

2.4.2. Systemic Constraints

Although willingness to adopt circular practices is growing, the ability of housing associations to do so is limited by a set of systemic constraints. These function as a filtering layer between external imperatives and internal strategic choices, reinforcing linear development pathways.

Financial limitations are among the most persistent. Despite the abolition of the *verhuurderheffing*, its legacy of financial caution remains. Housing associations face rent caps, borrowing restrictions (e.g., via the WSW), and are obligated to upgrade their existing housing stock to meet national climate targets. This parallel sustainability ”must”, retrofitting existing homes, competes for scarce financial and organizational resources, constraining innovation in new-build projects.

Procedural and technical constraints also play a role. Circular construction often entails longer planning phases, greater complexity, and unfamiliar procurement structures. Existing routines, optimized for linear delivery, offer little flexibility. Environmental regulations, such as nitrogen emission limits, introduce further permitting uncertainties that make complex projects riskier.

Finally, the housing crisis reinforces a short-term, volume-oriented mindset. With housing associations now responsible for a quarter of all new-build output, attention is increasingly focused on rapid, traditional (linear) delivery. Within such a performance-driven context, experimentation with circular methods is often seen as an operational liability.

2.4.3. Value Tensions

The simultaneous pressure to deliver housing rapidly and to contribute to circular goals creates a structural conflict within housing associations. Traditional construction approaches align closely with performance values: speed, affordability, and predictability. In contrast, circular construction requires longer timelines, more risk tolerance, and alternative forms of expertise.

This practical mismatch reveals a deeper, value-based tension. Drawing on public value governance literature (Kuitert et al., 2022), the challenge can be understood as a misalignment between three types

of public values:

- **Performance values:** efficiency, cost control, and high-volume delivery.
- **Product values:** long-term sustainability, innovation, and quality.
- **Process values:** transparency, legitimacy, and participatory governance.

In crisis conditions, performance values tend to dominate. Policy instruments, regulatory oversight, and political messaging all reinforce short-term targets and quantifiable outcomes. Product and process values, which underpin circularity, are typically harder to measure and less directly incentivizes, making them more difficult to prioritize within existing delivery models.

The conceptual framework illustrates how this misalignment results in diverging development pathways: a dominant, performance-driven route and a secondary, aspirational route aligned with circular goals. Housing associations must continuously balance these expectations, often within institutions and systems that favor the former.

2.4.4. Capacity-Circularity Gap

At the heart of this thesis lies what is termed the **Capacity-Circularity Gap**: the structural space between what housing associations aspire to do in terms of circular construction, and what they are actually equipped to do within current constraints. This gap is not only operational; it is systemic.

While the Circularity Imperative inspires ambition, it is not matched by an equivalent capacity. Financial rules, performance agreements, institutional risk-aversion, and the pressure of crisis-driven delivery combine to limit space for experimentation. As shown earlier, associations must also retrofit existing stock, a legally binding and resource-intensive obligation, which competes with investments in circular new build.

Circular projects typically demand upfront investment, longer timelines, and a tolerance for complexity. These are difficult to reconcile with risk-averse business cases and linear workflows optimized for output metrics. As a result, circular initiatives are often reduced to isolated pilots or delegated to external partners, without wider strategic integration.

The Capacity-Circularity Gap thus reflects a disjunction between ambition and structural feasibility. It explains why, despite increasing interest, circular construction remains peripheral in most housing association portfolios. Recognizing this gap is essential to identifying how housing associations might be better supported or structurally enabled to shift toward more circular practices.

2.4.5. Towards Theoretical Insight

Having laid out the systemic pressures, institutional constraints, and value tensions shaping housing associations' decisions, this chapter concludes by reaffirming the central challenge: the Capacity-Circularity Gap.

Addressing this gap requires more than technical innovation or project-level ambition. It calls for a deeper understanding of the institutional, financial, and governance dynamics that limit circular uptake. The next chapter therefore turns to the academic and applied literature. It reviews research on circular construction, transition theory, and organizational capacity to better understand what barriers exist and what mechanisms might enable housing associations to move toward a more circular trajectory.

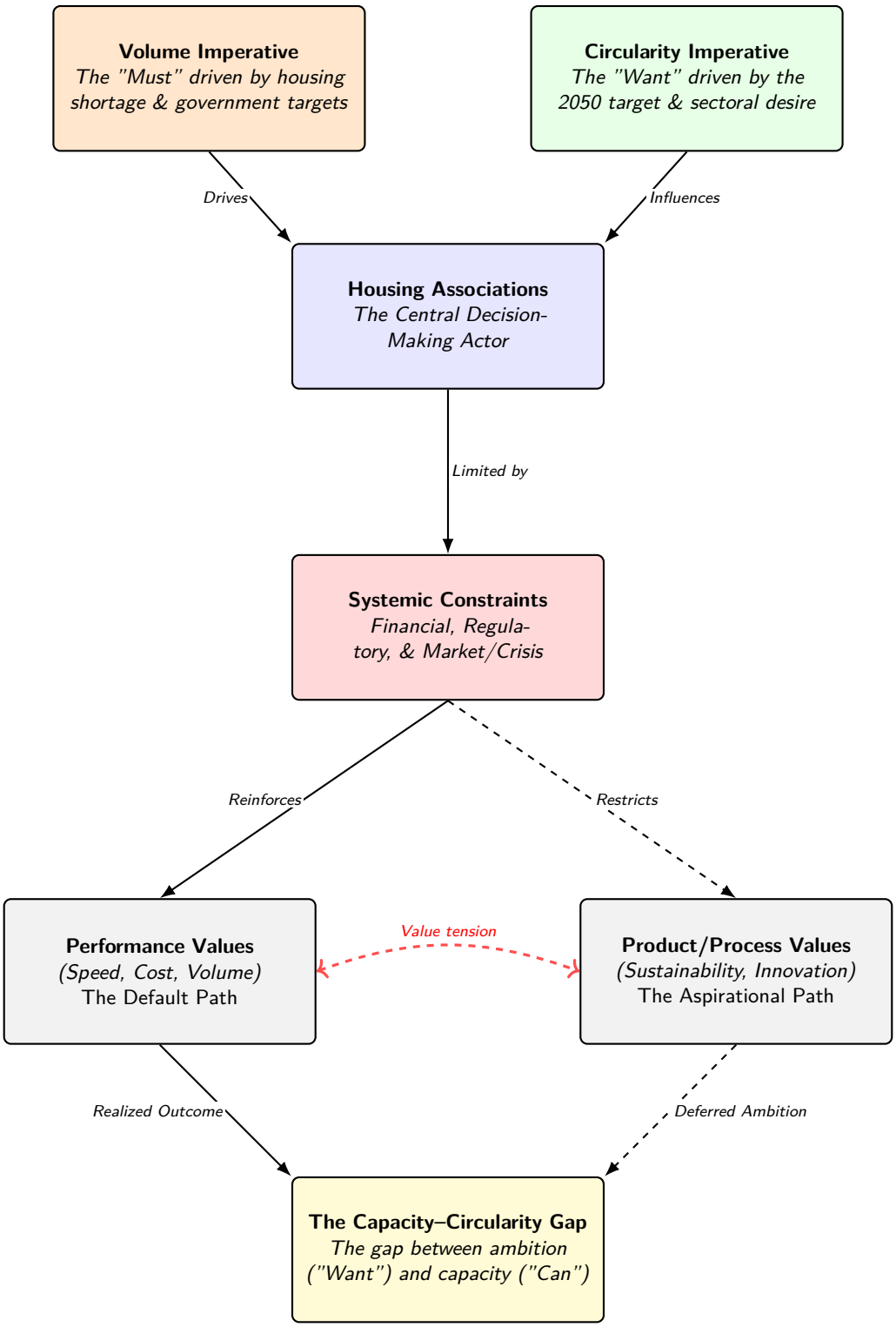

Figure 2.4: Conceptual Framework

3

Literature Review

This chapter surveys the academic and practice-oriented literature on circular construction and addresses the second sub-question:

- **Sub-question 2** - According to the academic literature, what concepts, strategies, barriers, and enablers govern a transition to circular construction?

To answer this question, the chapter reviews academic and applied literature on the circular economy and its application in the construction sector. The aim is to clarify how circularity is defined, how it relates to construction practices, and what theoretical insights can inform the empirical analysis later in the thesis.

The chapter is structured into two sections. Section 3.1 introduces the concept of the circular economy, explores how it translates into construction, and identifies key barriers and enablers as discussed in the literature. Section 3.2 synthesizes these insights into a theoretical framework that highlights strategic tensions, mindset dynamics, and potential pathways for circular adoption in the Dutch housing association context.

This literature review lays the groundwork for the empirical research presented in Chapter 6, by establishing the conceptual language, thematic structure, and analytical expectations against which the interview data can later be interpreted.

3.1. Circular Economy

The concept of the circular economy (CE) has developed as a central framework in the pursuit of sustainable development, especially within resource-intensive sectors such as construction. Unlike the traditional linear economic model, which is based on extraction, production, use, and disposal, the circular economy emphasizes closed material loops, resource efficiency, and the minimization of waste and emissions. Over the past decade, the CE concept has gained substantial traction in both policy and practice, underpinned by the recognition that global resource constraints and environmental challenges require a fundamental shift in how materials, products, and buildings are designed, used, and regenerated. This section introduces the core definitions and principles of the circular economy, examines how these ideas translate into the construction context, and explores the main barriers and enablers influencing their adoption in practice.

3.1.1. Definition of Circular Economy

The circular economy concept was initially introduced by Pearce and Turner (1990), who emphasized the importance of recognizing the economy's relationship with the environment, an idea that contrasted with the traditional economic focus on cost-benefit analysis (Pearce & Turner, 1990). They proposed replacing the conventional 'take-make-dispose' model with systems designed to keep materials and energy operating for an extended period.

The concept of CE became more widely known after 2015, partly due to the work of Ellen MacArthur

Foundation (2015). They described CE as ”restorative by design” and explained that its main purpose is to maintain the value of products, components, and materials for the longest possible duration in both technical and biological cycles (Ellen MacArthur Foundation, 2015). This definition has had a strong impact on both academic literature and real-word application.

Over time, various scholars have built upon earlier CE ideas. For instance, Geissdoerfer et al. (2017) describe CE as “a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops.” This definition suggests that CE seeks to minimize the consumption of raw materials, the generation of waste, and the loss of energy. According to Mendoza et al. (2019), narrowing these loops involves developing eco-efficient solutions that help lower the environmental effects of products and services. Additionally, Bocken et al. (2016) point out that slowing loops can prolong product use, closing loops allows materials to be reused through recycling or re-manufacturing, and narrowing loops contributes to overall resource reduction.

A useful tool for explaining CE in practice is the “10 R” framework (see table 3.1 (Peiró et al., 2020; Potting et al., 2017; Vermeulen et al., 2019). In the construction industry, these “R” options can guide decisions about minimizing waste and maximizing resource recovery (Pomponi & Moncaster, 2017).

Table 3.1: The 10 R Framework for Circular Economy (adapted from Potting et al. (2017))

R Option	Description
R0 Refuse	Make product redundant by abandoning its function or by offering the same function with a radically different product.
R1 Rethink	Make use of the product more intensively (e.g. by sharing the product).
R2 Reduce	Increase efficiency in product manufacture or use by consuming fewer natural resources and materials.
R3 Reuse	Reuse by another consumer of a discarded product that is still in good condition and fulfills its original function.
R4 Repair	Repair and maintain a defective product so it can be used with its original function.
R5 Refurbish	Restore an old product and bring it up to date.
R6 Remanufacture	Use parts of a discarded product in a new product with the same function.
R7 Repurpose	Use a discarded product or its parts in a new product with a different function.
R8 Recycle	Process materials to obtain the same (high-grade) or lower (low-grade) quality.
R9 Recover	Incinerate materials with energy recovery.

3.1.2. Definition of Circular Construction

Traditional construction often follows a linear or “cradle-to-grave” approach, where the focus ends once the building is completed and eventually demolished (Guerra & Leite, 2021). In contrast, a circular or “cradle-to-cradle” perspective looks at the whole lifecycle of a building or a product, including how materials can be recovered or reused at the end of life (Geissdoerfer et al., 2017).

In construction, this means not only focusing on completing the project but also on how to disassemble and reuse materials later (Pomponi & Moncaster, 2017). CE aims to eliminate or greatly reduce negative environmental impacts rather than just delay them (McDonough & Braungart, 2010). To achieve this, changes are needed in building design, policy, supply chain collaboration, and the overall mindset of stakeholders. These changes will be discussed in more detail in the next sections.

3.1.3. Circular Economy in Construction

The construction sector plays a pivotal role in global resource consumption and waste generation, consuming over 40% of the world's raw materials and producing a significant portion of global greenhouse gas emissions (de Wit et al., 2018; IEA, 2020a). In the Netherlands specifically, construction-related supply chains are responsible for more than 35% of total national waste output (Bijleveld et al., 2015). In response to these environmental pressures, governments, among them the Dutch administration, have started to implement measures aimed at reducing the extraction of raw materials, stimulating circular procurement, and cutting CO_2 emissions in the built environment (Nelissen et al., 2018; Rijksoverheid, 2016).

Beyond the material impact of construction activities, buildings also contribute significantly to environmental degradation throughout their lifecycle, particularly during the use phase when energy consumption is highest (Ramesh et al., 2010). Although improvements in operational energy efficiency have been achieved in recent decades, growing attention is now being paid to embodied carbon, the emissions associated with material production, transport, and construction, and how circular practices can help reduce it (Blengini & Di Carlo, 2010).

Scholarly work has identified several strategies for promoting circularity in the construction industry. Among the most prominent are the development of closed-loop supply chains, the design of buildings for future disassembly and reuse, and the incorporation of renewable, bio-based materials. These strategies aim to intervene at multiple stages of the building lifecycle, encouraging supply chain transformation, innovative design thinking, and material substitution to extend resource life, reduce environmental burden, and decouple economic activity from the consumption of finite resources.

Closed-Loop Supply Chains. Applying circular economy principles to the construction sector involves rethinking traditional linear supply chains in favor of closed-loop systems. These systems combine conventional logistics, such as the delivery of raw and processed materials to building sites, with reverse logistics, where materials from demolition, refurbishment, or end-of-life phases are recovered and reintegrated into new construction cycles (Pishvaee & Torabi, 2010). Effectively managing such closed-loop supply chains (CLSCs) requires strategic oversight that preserves material value across the entire lifecycle of a building and even into multiple reuse cycles (Guide & Van Wassenhove, 2009). Techniques associated with CLSCs include designing products and buildings with future disassembly in mind, implementing service-based business models, and fostering close collaboration among supply chain actors (Coenen et al., 2018; Schenkel et al., 2015).

Design for Disassembly and Reuse. An essential approach to circular construction is designing buildings in such a way that they can be easily taken apart, with the goal of reusing components at the end of their initial life (Eberhardt et al., 2019; Rios et al., 2015). This method, commonly referred to as Design for Disassembly (DfD), embeds considerations for reuse, refurbishment, or recycling from the earliest stages of the design process. In parallel, researchers highlight the importance of reusing existing structures or building components whenever possible (Mhatre et al., 2020). Doing so not only reduces the need for virgin materials but also helps extend the useful life of already-produced resources.

Bio-based Materials. The use of bio-based materials, such as timber, as alternatives to more carbon-intensive construction materials like steel and concrete is gaining traction due to their potential environmental advantages (Andersen et al., 2021; Hertwich et al., 2019). Nevertheless, scaling up their use must be approached with caution to avoid unintended consequences, including land degradation and loss of biodiversity (Pomponi et al., 2020). To ensure positive outcomes, bio-based construction should be accompanied by circular design practices and supported by sustainable sourcing and land-use policies (Zhong et al., 2021).

3.1.4. Barriers

The shift to a circular economy in the construction industry is hindered by complex barriers spanning economic, technical, social, regulatory, and systemic dimensions. These challenges, rooted in the sector's complexity and entrenched practices, obstruct the adoption of restorative, closed-loop systems.

Economic and Financial Barriers

A persistent obstacle to circular construction lies in its unfavorable cost structure. Reclaimed components often emerge from labor-intensive deconstruction, sorting and re-certification processes, which drive their price above that of virgin products (Huang et al., 2018; Mahpour, 2018). Buyers therefore face higher material costs, while low landfill fees make disposal the cheaper alternative, eroding any immediate financial incentive to choose re-use (Grafström & Aasma, 2021; Rakhshan et al., 2021). Because recovered materials are expensive and always result in increased material prices for building construction projects, clients are unable to demand these sustainable materials (Genc, 2021). This is demonstrated by suppliers avoiding such costly commodities, which has an impact on the supply and demand for those materials.

High up-front investment requirements compound the problem. Circular business models frequently call for new infrastructure, dedicated R&D and third-party certification, all of which add significant capital outlay before revenue can be generated (Guerra & Leite, 2021), these costs are difficult to justify within conventional project budgets and further widen the price gap between circular and linear options.

Financing practices reinforce short-term thinking. Construction firms often operate under tight cash flows and seek rapid pay-back periods, while lenders prefer transactional arrangements with quick returns (Carra & Magdani, 2017). The absence of widely accepted financial tools and reporting standards makes it harder to capture life-cycle benefits in a business case, leaving many funding applications unsupported (Adams et al., 2017; Kirchherr et al., 2018). Budget contingency for unfamiliar methods, together with higher consultancy fees for circular design expertise, further deters adoption (Hosni et al., 2020).

Technical and Technological Barriers

Technical and technological obstacles play a significant role in impeding the transition toward circular construction practices. A frequently discussed issue in academic literature is the absence of comprehensive design codes and standards tailored to support the integration of reclaimed materials or aimed at minimizing Construction and Demolition Waste (CDW) (Gupta & Chaudhary, 2020; Rakhshan et al., 2021; Santos et al., 2024; Veleva et al., 2017). This regulatory gap generates uncertainty for professionals in the field and restricts the incorporation of circular concepts into routine construction workflows. Although some progress has been made in developing such standards in parts of Europe, their availability and consistency remain limited (Mahpour, 2018).

A further technical difficulty lies in the lack of accessible and practical knowledge on how to design with reused materials (Campbell-Johnston et al., 2019; Charef & Lu, 2021). This challenge is compounded by insufficient policy support and weak promotion of sustainable design innovations, which together hinder the adoption of experimental or circular methods (Ghisellini et al., 2018). From a logistical perspective, the scarcity of storage facilities for reclaimed building components presents an additional hurdle; without appropriate storage, maintaining the usability and quality of such materials becomes problematic (Guerra & Leite, 2021; Tingley et al., 2017).

Early design choices are also pivotal. A number of studies point out that most buildings are still conceived without considering how they might be disassembled or how materials could be recovered after their use phase (Kanters, 2018; Rakhshan et al., 2020; Yuan et al., 2020). This lack of foresight, combined with minimal access to deconstruction expertise and spatial limitations for storing salvaged materials, significantly reduces the feasibility of material reuse (Boukherroub et al., 2024; Veleva et al., 2017). Encouraging the involvement of deconstruction professionals in early project stages and embedding end-of-life considerations into design workflows could greatly improve circular outcomes, yet these practices remain unsupported by current design codes and waste management policies (Huuhka & Hakanen, 2015; Morel & Charef, 2019).

From a technological perspective, the sector suffers from limited access to tools and systems necessary for supporting a circular economy. Technologies that enable efficient maintenance, disassembly, reuse, and recycling are still insufficiently developed, which restricts efforts to reduce waste and enhance resource recovery throughout the building lifecycle (Thirumal et al., 2024; van Eijk, 2015). Although there is increasing interest in digital tools for lifecycle planning and circular decision-making, these systems are either not yet fully developed or poorly embedded in industry practice (Charef & Lu, 2021; Sanchez & Haas, 2018).

In addition, the construction sector's fragmented setup, where multiple stakeholders operate separately across different project stages, creates coordination difficulties and slows down the adoption of circular innovations (Acharya et al., 2018; Torgautov et al., 2021). End-of-life processing technologies are also still emerging, and uniform metrics to evaluate circular performance are lacking. Finally, the limited availability of environmentally innovative construction products continues to highlight the technological gap and constrains the sector's ability to implement circular strategies effectively (Tingley et al., 2018).

Social and Cultural Barriers

Social and cultural dynamics pose significant obstacles to the widespread implementation of circular construction. One of the core challenges is the sector's entrenched reliance on linear economic principles, where conventional practices related to material consumption, ownership, and prestige are deeply woven into industry traditions (Hart et al., 2019). This entrenched mindset often summed up by the phrase "this is how we've always built", fosters a general reluctance to embrace alternative approaches (Acharya et al., 2018).

Efforts to introduce innovation or start-up-driven circular solutions are often stifled by the sector's conservative risk profile and narrow financial margins, both of which reduce the willingness to test unproven models (Acharya et al., 2018). On a broader level, limited awareness, interest, and engagement among actors across the construction value chain remain key factors delaying the adoption of circular principles (Kirchherr et al., 2018). Within companies, departmental silos, particularly between design, operations, and maintenance, impede the integrated thinking and collaboration that are critical for successfully applying circular strategies (Hart et al., 2019).

Another widely acknowledged barrier is the generally low level of knowledge and familiarity with circular economy practices among construction professionals (Charef, Ganjian, & Emmitt, 2021; Gue et al., 2020; Hosseini et al., 2015; Mahpour, 2018; Tingley et al., 2017). Gaps in education and professional training are repeatedly identified as core impediments, with multiple studies pointing to the lack of structured instruction on circular principles as a major factor holding back implementation (Chileshe et al., 2015; Morel & Charef, 2019; Pitti et al., 2020).

Policy and Regulatory Barriers

Weaknesses in the current policy and legislative landscape present substantial barriers to the widespread adoption of circular economy practices in the construction sector. One of the central challenges lies in the lack of coherent and consistent regulations at both the city and regional levels. Existing rules concerning the reclamation, reuse, and recovery of construction components often vary significantly across jurisdictions, making it difficult for stakeholders to operate within a clear and supportive legal framework (Rios et al., 2021).

Another barrier is the limited global consensus on policy support for CE. Although there has been growing attention to circularity, most policy efforts still focus on basic goals such as reducing landfill use, without addressing broader targets related to material circularity and reuse (Hill, 2015). This narrow policy scope hampers more systemic CE integration in the built environment.

Local laws often exacerbate the issue by restricting CE practices through rigid classifications of waste, limited data accessibility, and insufficient interoperability between facilities that process recovered materials. These legal barriers obstruct collaboration and the formation of efficient reuse networks, which are essential for the functioning of a circular construction ecosystem (Charef & Lu, 2021; Pomponi & Moncaster, 2018).

Additionally, the lack of design standards for integrating recovered materials into new construction projects further deters CE implementation. The absence of these guidelines, coupled with broader political and regulatory hesitation, limits industry confidence and hinders innovation. As such, there is a strong need for regulatory mechanisms, whether fiscal incentives or legislative reforms, that can encourage both individuals and organizations to commit to circular practices (Ababio & Lu, 2022; Charef & Lu, 2021; Pomponi & Moncaster, 2018).

3.1.5. Enablers

While the barriers to implementing a circular economy in construction can be significant, there are also many drivers and enablers that can help overcome these challenges. These drivers emerge

from supportive policies, collaborative partnerships, technological advances, financial incentives, and growing social awareness. The following subsections discuss some of the key factors that can facilitate the successful adoption of CE in the construction sector.

Policy and Governance

Supportive policy frameworks are identified as a key enabler for advancing the transition to circular economy practices in the construction sector. Robust regulatory measures can help guide innovation, establish clear metrics, and influence practical implementation, particularly in areas such as public procurement (Acharya et al., 2018). Hill (2015) emphasizes the importance of regulatory reform that promotes collaboration across the construction value chain, suggesting that policy alignment can accelerate the uptake of circular strategies.

The example of Shenzhen in China illustrates how assertive governmental action, particularly through targeted policy tools, can effectively accelerate the adoption of circular economy practices in the construction sector (Bao & Lu, 2021). However, policy alone is not sufficient. Stakeholder consultation at the project level is essential, especially when conducted early in the process. The report by Arup (2016) highlights that industry–stakeholder engagement can stimulate demand for CE by fostering shared understanding and ownership of circular goals.

Beyond regulation and consultation, public awareness and education are also highlighted as crucial enablers. Partnering with governmental bodies can play a pivotal role in promoting awareness of the advantages and potential of circular economy practices within the construction industry (Antwi-Afari et al., 2021). Mathur et al. (2008) argue that dialogue is a powerful tool for changing attitudes and behaviors, while Glavič et al. (2020) call for economic and consumption transformation supported by educational strategies.

Collaboration, Partnerships, and Education

Improved collaboration and education are widely recognized as crucial enablers for advancing circular construction. Many of the social and cultural barriers hindering the adoption of circular strategies, such as the belief that reused materials are of lower quality, can be mitigated through targeted education and awareness efforts. Continuous training on the use and benefits of reclaimed materials helps challenge outdated assumptions and increase acceptance among both professionals and the public (Charef, Ganjian, & Emmitt, 2021). Aesthetic improvements and showcasing successful examples of reclaimed materials in real projects can further enhance their market appeal (Charef, Ganjian, & Emmitt, 2021; Häkkinen & Belloni, 2011).

Collaboration along the value chain is also essential. Hill (2015) highlights the need for regulatory reforms that actively promote cooperation between stakeholders in the construction sector. Early and meaningful consultation, particularly during the project planning phase, can align expectations and stimulate demand for circular approaches (Arup, 2016). Bao and Lu (2021) show that government-led coordination, as demonstrated in Shenzhen, can rapidly accelerate CE implementation by creating a shared framework for action.

Education plays a pivotal role across all levels of the industry. Antwi-Afari et al. (2021) stress that without strong educational foundations, the goals of CE within the broader sustainable development agenda cannot be realized. Mathur et al. (2008) suggest that open dialogue can be a valuable tool to shift attitudes and encourage behavioral change. To support this shift, Glavič et al. (2020) recommend linking educational initiatives to wider economic and consumption reforms.

Technological Innovations

Technological innovation plays an important role in promoting circular construction practices. While Adams et al. (2017) argue that technological constraints are not the most pressing barrier, the literature makes clear that innovation is essential for enabling systemic shifts. Transforming the construction industry towards circularity requires more than incremental change, it demands a complete redesign of processes, systems, and products supported by advanced technological tools (Duong et al., 2021).

New technologies such as the Internet of Things (IoT), 3D printing, and digital twins offer substantial potential for improving material efficiency and lifecycle management in construction. These technologies can enable better tracking, optimization, and reuse of resources throughout the building lifecycle.

Additionally, sharing schemes for underutilised assets and broader deployment of resource recovery technologies can help close material loops and reduce waste (Hopkinson et al., 2018).

In the early design phase, circular construction is best supported by approaches like Design for Disassembly (DfD), Design for Manufacture and Assembly (DfMA), and Design for Adaptability (DfA). These techniques become more impactful when integrated with digital tools, such as Building Information Modeling (BIM), material passports, and shared knowledge platforms, that promote transparency and facilitate planning for future reuse and recycling (Tingley et al., 2018).

To overcome technical barriers more directly, researchers emphasize the need for updated building codes and regulations. Peñate-Valentín et al. (2021) call for the development of standards that specifically support deconstruction and the reuse of materials. Likewise, Huang et al. (2018) advocate for changes to construction codes that would allow reclaimed materials to be integrated into new buildings. Mandatory policies on construction waste management could also compel professionals to adopt circular practices, seek CE training, and reduce overall construction and demolition waste (Hosni et al., 2020).

Social and Cultural Drivers

Social and cultural enablers play a crucial role in promoting circular construction, particularly when it comes to changing perceptions, increasing awareness, and fostering behavioral change among stakeholders and the general public (Osei-Tutu et al., 2022). One of the key strategies identified in the literature is public education, aimed at addressing common misconceptions surrounding reclaimed materials. For example, the widespread belief that secondhand materials are of lower quality or aesthetically inferior can be mitigated through continuous education and training initiatives (Charef, Ganjian, & Emmitt, 2021). Ensuring that reclaimed components are visually appealing and effectively integrated into modern design can further help shift public attitudes (Gorgolewski, 2019; Häkkinen & Belloni, 2011).

Leadership by example is also essential. When high-profile stakeholders, including government agencies and industry leaders, incorporate reclaimed materials in their own projects, they send a powerful signal that such practices are both feasible and desirable (Osei-Tutu et al., 2022). This can significantly increase market preparedness and trust in circular solutions.

Raising awareness about the environmental consequences of excessive raw material use, as well as the economic risks of continued resource depletion, is another effective driver (Osei-Tutu et al., 2022). Education campaigns that highlight the ecological and financial benefits of circular practices can help foster a culture of material responsibility. At the same time, trust in reclaimed materials can be strengthened through transparent data sharing. Government-endorsed research and performance data can validate the strength and durability of reclaimed components, helping to reduce hesitation among construction professionals and clients alike (Charef, Ganjian, & Emmitt, 2021).

3.2. Theoretical Framework

This section builds on the conceptual framework from Section 2.4 in Chapter 2 by using insights from the literature review to identify possible strategies for bridging the gap between circular economy ambitions and the current realities faced by Dutch housing associations. It begins by recapping the core challenge established earlier, then draws on key themes from the academic literature to develop and justify three strategic pathways for further investigation in this thesis. The core elements of this analysis are illustrated visually in Figure 3.1, which outlines the mindset shift and strategic pathways discussed throughout this section.

3.2.1. From Structural Tension to Theoretical Insight

As established in Chapter 2, Dutch housing associations operate within a complex field of structural tensions. The urgent demand for rapid, cost-effective housing delivery is often at odds with the long-term ambition to realize CE principles in construction. These conflicting imperatives are reinforced by internal constraints such as rent ceilings, borrowing limits, and a regulatory focus on affordability and risk minimization. The result is what this thesis has termed the *Capacity-Circularity Gap*, a fundamental misalignment between current organizational routines and the new capabilities required for CE innovation.

Importantly, this gap is not only practical or procedural, but also value-driven. Associations face a systemic tension between performance values (speed, volume, efficiency), product values (sustainability, innovation), and process values (transparency, legitimacy). These values are frequently misaligned in both policy and practice. These orientations reflect how housing associations interpret and respond to the conflicting imperatives described in the conceptual framework. Understanding how to overcome the Capacity-Circularity Gap therefore requires a multi-level approach that integrates behavioral, institutional, and structural perspectives.

3.2.2. Key Lessons from Literature

The literature review confirms that the transition to circular construction is shaped by a mix of barriers and enablers across technical, financial, institutional, and cultural dimensions. While these dynamics affect the construction sector broadly, they carry specific implications for Dutch housing associations operating under strict affordability mandates and performance-driven routines. The findings reinforce the Capacity-Circularity Gap outlined in Chapter 2 and help identify conditions under which this gap may be bridged.

3.2.3. Mindset Shift

The literature shows that many of the barriers to circular construction are not only technical or financial in nature, but also related to how organizations think and behave. Within Dutch housing associations, practical challenges, such as high upfront costs, long payback times, and financial uncertainty, are difficult to address under strict rules related to rent caps, borrowing limits, and performance agreements that focus on short-term delivery and efficiency. These constraints reinforce existing routines and limit space for innovation.

In addition to financial and regulatory barriers, technical and organizational lock-ins also play a role. A lack of experience with circular design, missing standards for reuse, and siloed work structures make it hard to change existing practices. Cultural factors further complicate the transition, as circularity is often viewed as a secondary goal and may be postponed during periods of crisis or housing urgency.

However, several enablers can help create the conditions for circular construction. Many studies emphasize the importance of internal learning, awareness, and leadership. Developing knowledge within the organization and creating room for experimentation can help overcome resistance to change. Other supportive factors include more flexible financial tools, such as life-cycle costing, and stronger cooperation across the construction value chain.

Still, a recurring insight across the literature is that mindset plays a central role in enabling or blocking progress. Two main types of mindset can be observed. The first is a compliance-driven mindset, where actions are mostly taken in response to external rules or incentives (“we must”). In this case, circularity is not yet part of the organization’s own mission. The second is a responsibility-driven mindset, where circularity is embraced as part of the organization’s long-term goals (“we want to”). Most housing associations lie somewhere in between, depending on their leadership, internal culture, and local context.

Encouraging a more proactive and responsibility-based mindset is essential for change. Without awareness, long-term thinking, and internal motivation, technical solutions or policy changes alone are unlikely to succeed. As such, a shift in mindset is not just one of many enablers, it is the key starting point for bridging the Capacity-Circularity Gap.

3.2.4. Strategic Pathways

After establishing their internal orientation, the next step is to identify actionable areas where housing associations can begin to shift practice. These three areas are depicted in the lower part of the theoretical framework diagram (Figure 3.1). While many structural constraints lie outside their direct control, the literature and context study reveal several internal domains where housing associations do have agency. These are leverage points, areas in which deliberate effort can help reduce the Capacity-Circularity Gap.

Three such domains emerge as particularly relevant. They do not offer quick fixes, but they represent strategic pathways through which associations can begin to build capacity, embed circular principles,

and challenge the inertia of linear routines.

- **Pathway A: Developing Circular Expertise**
  Circular construction demands new technical knowledge, design approaches, and evaluative criteria. Staff at all levels need exposure to these ideas through training, knowledge sharing, and participation in pilot projects. Organizational learning is a prerequisite for breaking through cultural resistance and silo-ed thinking.
- **Pathway B: Redesigning Performance Metrics**
  Associations must rethink how they define value and success. Current financial frameworks often prioritize short-term cost and speed. To enable circular projects, metrics need to shift toward life-cycle value, total cost of ownership, and long-term environmental benefit. This may involve adapting tendering procedures, experimenting with new contract forms, or advocating for more supportive financing models.
- **Pathway C: Building Market Supply**
  Associations must engage more actively with the broader construction ecosystem. Circular construction requires close coordination with designers, suppliers, contractors, and municipalities. By investing in partnerships, joint ventures, and knowledge platforms, housing associations can co-develop practical solutions and lower the perceived risk of innovation. Collaboration also helps align goals and distribute responsibility.

These pathways are not independent. Rather, they reinforce one another: expertise supports better procurement; new procurement logic enables stronger partnerships; partnerships bring in new knowledge. Together, they form a strategic response to the internal constraints outlined earlier, and a practical starting point for housing associations that seek to move from ambition to realization.

3.2.5. Need for Empirical Insight

This theoretical framework has outlined how housing associations operate under conflicting imperatives and face multiple barriers to circular construction. It has also proposed that a strategic response can be shaped around three key areas: developing knowledge, rethinking performance logic, and fostering collaboration.

However, the literature and context study can only take us so far. While they clarify what housing associations might need to change, they do not yet explain how these shifts occur in practice, or what shapes the organizational stance toward circularity in the first place.

To better understand the factors influencing strategic orientation, such as institutional expectations, internal culture, leadership views, and past experiences, further empirical insight is needed. Interviews with housing association professionals and related stakeholders can help reveal how these organizations interpret their role, how they navigate constraints, and how the proposed pathways are already being explored, challenged, or adapted in real-world projects.

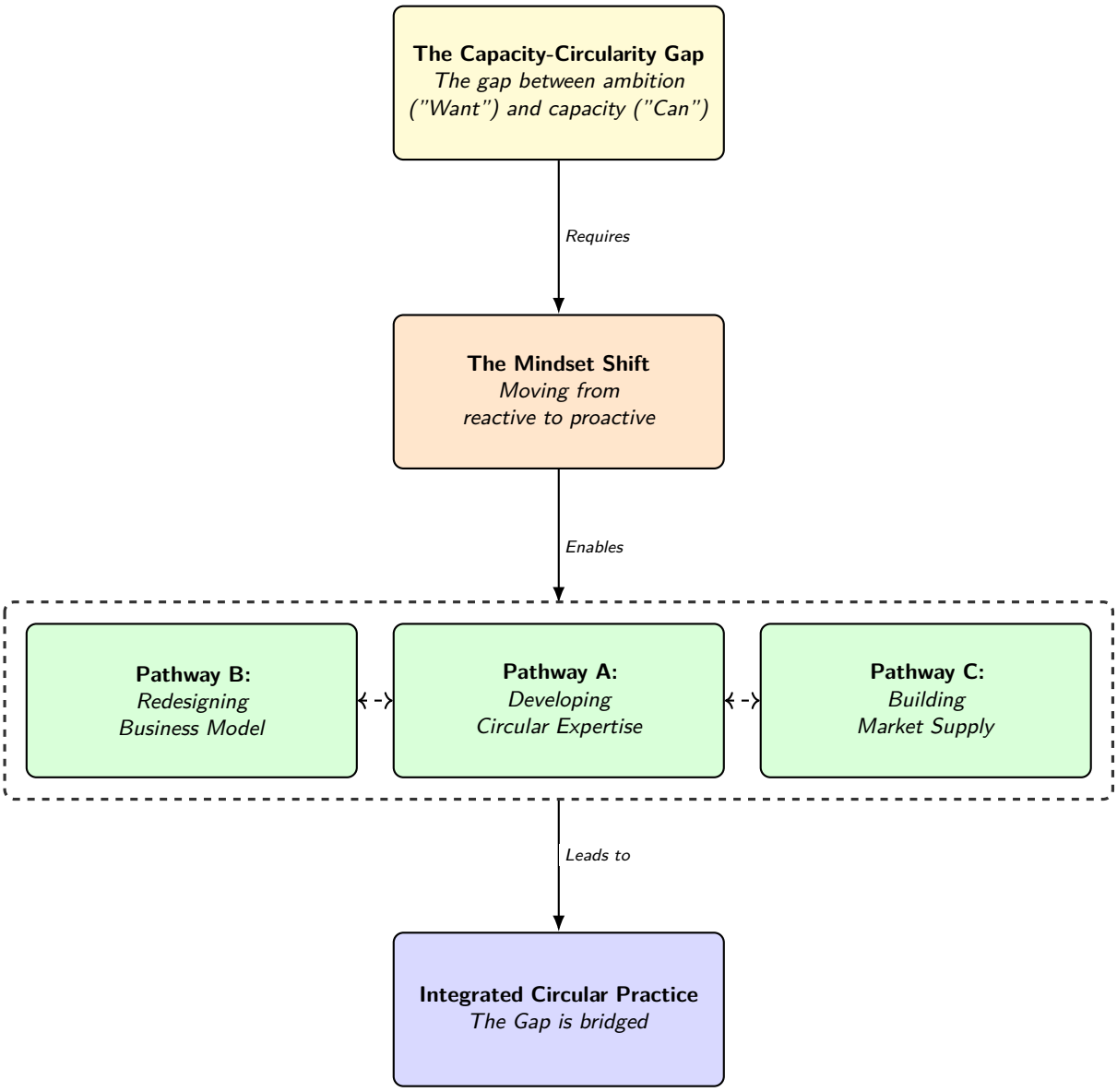

Figure 3.1: The Theoretical Framework

4

Phase I Conclusion

Phase 1 brings together the context study and the literature review to define the problem space and set the course for the empirical work. Dutch housing associations operate under two coinciding imperatives: a Volume Imperative that prioritizes speed, cost, and output, and a Circularity Imperative that aligns with long-term sustainability goals. Policy targets and performance agreements reward output. Financial and risk rules prioritize cost control and predictability. Delivery routines remain largely linear. Together, these features cause performance values to dominate product and process values. The result is a Capacity-Circularity Gap: circular ambition is present, yet capabilities and incentives are not aligned to deliver circular outcomes across the portfolio.

In practice, the gap appears as circular measures that remain the exception rather than the default. Circular elements are often limited to pilots or one-off projects, and are assessed with metrics that favor lowest upfront cost over life-cycle value. Procurement rules, warranty practices, and limited standardization steer choices back to familiar linear solutions. As a result, decisions housing associations make focus on delivering volume reliably, while circular goals advance unevenly and rarely reach scale.

The two imperatives can stand alongside each other only if “performance” is broadened in how projects are planned, financed, and delivered. Decision frameworks need to value life-cycle outcomes alongside speed and cost; material circularity must be treated as a performance objective rather than an add-on; and planning and finance should include room for learning, such as phased adoption, pilots with feedback, and risk-sharing that does not penalize first movers. Procurement and warranties need to recognize circular specifications as legitimate and comparable; data and measurement must make circular results visible and auditable; and internal skills must be sufficient to specify, evaluate, and manage circular options. Without these counterweights, short-term throughput will continue to set the terms of choice, and circular options will struggle to become routine.

From this diagnosis, three pathways follow that translate a broader view of performance into practical levers for housing associations:

a) **Develop Circular Expertise** - build the skills, tools, and routines needed to specify circular requirements, assess alternatives on life-cycle value, and manage delivery risks with confidence.

b) **Redesigning Business Model** — bring longer-term effects and clear circular performance criteria into go/no-go, selection, procurement, and contracting, with an explicit time horizon and proportionate evidence (e.g., maintenance over time, adaptability, and component-level reuse potential), so circular options can compete on equal terms with familiar ones.

c) **Build Market Supply** - organize demand and partnerships to improve availability, standardization, and reliability of circular components and services, reducing perceived risk and cost.

These pathways shape the focus of the next chapters. The empirical work will examine how associations currently develop capability, how life-cycle value and circularity are reflected in decisions and contracts, and how demand is coordinated with partners to strengthen supply. The aim is to iden-

tify which conditions allow these pathways to take hold, how they influence day-to-day choices, and whether they help close the Capacity-Circularity Gap at project and portfolio level.

II

Phase

5

Methodology

This chapter outlines the qualitative research design used to investigate how Dutch housing associations perceive and navigate the barriers and enablers of circular construction. The study aimed to explore both the relevance of established barrier/enabler themes in the Dutch housing context and how organizations prioritize between urgent housing needs and long-term sustainability goals. To this end, five semi-structured interviews were conducted with professionals working in or closely with housing associations.

The chapter proceeds as follows: Section 5.1 explains why semi-structured interviews were selected and how they suit the research goals. Section 5.2 describes the data-collection process, including how participants were selected and how interviews were conducted. Section 5.3 then outlines the five-phase thematic analysis used to process and interpret the interview material. Together, these sections explain how the study generated empirical insights that are later presented in Chapter 6.

5.1. Interview Approach

A qualitative, semi-structured interview method was chosen because it matches the exploratory aim of Sub-question 3 and suits the special situation of Dutch housing associations.

The literature review listed four common barrier themes and five enabler themes, but their importance can change under the strict rent rules, WSW borrowing limits, and social tasks that Dutch housing associations face. Semi-structured interviews let the researcher ask the same basic questions while still digging deeper into how these themes appear in their decision-making.

An interview guide keeps every conversation on the same core topics: project workflow, barriers, enablers, yet open follow-up questions allow new ideas to surface. This mix is recommended when different job roles (for example, portfolio managers, sustainability advisers, or city officials) may use different words for the same issue (Kallio et al., 2016).

5.2. Data Collection

The main objective of the data collection phase was to gain a detailed understanding of how professionals working in or with Dutch housing associations perceive the barriers and enablers to implementing circular construction. Specifically, the interviews sought to uncover how these organizations prioritize between urgent housing needs and long-term sustainability ambitions, which practical and institutional challenges they face, and what kinds of solutions or strategies they see as feasible in their daily practice. By collecting these insights, the study aimed to bridge the gap between theoretical frameworks and the real-world context of Dutch social housing.

To explore the integration of CE principles in Dutch housing associations and understand the tension between short-term housing urgency and long-term sustainability ambitions, qualitative data was collected through semi-structured interviews with housing association professionals and municipal stakeholders.

These sources helped to generate insights into both the institutional framework and the practical realities encountered during housing development.

5.2.1. Interviews

Semi-structured interviews were selected as the primary method for empirical data collection, as they offer a balance between structure and flexibility. As Kallio et al. (2016) explained, this method is well-suited for examining professional practices and organizational processes because it ensures that core themes are consistently addressed while still allowing interviewees to elaborate on their own experiences and perspectives. This flexibility is particularly valuable in qualitative research where emerging topics may arise during the conversation.

In this study, the interviews focused on the development process of new housing projects, stakeholder interactions, and the perceived barriers and enablers to implementing circular construction. Special attention was given to how sustainability ambitions are considered or set aside during planning and implementation, especially in situations characterized by urgency.

Kallio et al. (2016) further emphasize that semi-structured interviews are especially appropriate in contexts involving complex decision-making and multiple stakeholders. This approach enabled participants to reflect on real-life choices, trade-offs, and institutional constraints, offering insights into how short-term pressures and long-term sustainability goals are negotiated in practice.

5.2.2. Interview Guide

The interview questions were organized around five core dimensions relevant to the research questions:

- General project development process within housing associations;
- Current housing development priorities (affordability, speed, sustainability);
- Barriers to implementing circular construction;
- Enablers, policies, and financial tools supporting circularity;
- Stakeholder relationships and roles in housing delivery.

The guide was adapted slightly depending on the background of the participant (e.g. housing association vs. municipality). Interviewees were encouraged to provide concrete examples and reflect on challenges they have experienced.

The interviews provided rich qualitative data, allowing for a deeper understanding of how short-term housing urgency interacts with long-term circular ambitions. The next section describes the data analysis method used to interpret these interviews and derive results for the study.

5.2.3. Participants

Interviewees were selected based on their roles in decision-making processes within housing associations or municipalities. These functions were considered most relevant to this research, as they directly deal with portfolio management, project development, and sustainability strategy, core themes in understanding the tension between rapid housing production and circular building practices.

Five interviews were conducted with professionals working in or with the the Dutch public housing sector. These included portfolio managers and directors from four different housing associations and an alderman from a Dutch municipality. The interviewees were selected based on their active involvement in housing development, their experience with sustainability policies, and their ability to provide insight into internal decision-making processes.

The participants were selected to reflect a mix of organizational roles and perspectives, particularly distinguishing between those implementing housing projects and those involved in policy or regulatory frameworks. An overview of the interviewees is shown in Table 5.1.

To protect the identity of the interviewees while maintaining clarity, pseudonyms such as SI1–SI5 were assigned. These codes correspond to their organization and role but avoid disclosing specific identities.

Table 5.1: Exploratory Interview Samples

Code	Organization	Role	Homes	Interview Date
SI1	Housing Association	Portfolio Manager	50,000	24-01-2025
SI2	Housing Association	Managing Director	8,000	27-01-2025
SI3	Housing Association	Strategic Portfolio Researcher	24,000	30-01-2025
SI4	Housing Association	Portfolio Manager	21,000	03-02-2025
SI5	Municipality	Alderman	n/a	07-02-2025

5.3. Data Analysis

A five-phase thematic-analysis procedure based on Braun and Clarke (2006) was applied. The interviews were recorded, transcribed, coded, and analyzed in five steps: (1) transcription and cleaning, (2) coding, (3) thematic grouping, (4) identification of core themes, and (5) preparation for results presentation.

Initial themes were extracted from the literature review chapter 3, focusing on subjects such as affordability constraints, policy influence, procurement, market maturity, and urgency. These provided a conceptual foundation, while inductive coding ensured that unanticipated themes could also emerge from the interviews, providing a fuller picture of the housing associations' situation.

5.3.1. Thematic Analysis Procedure

To structure the analysis process, this thesis adopted a five-phase thematic analysis procedure based on Braun and Clarke's (2006) foundational work (see figure 5.1). This approach allows for a systematic and iterative process of handling qualitative data.

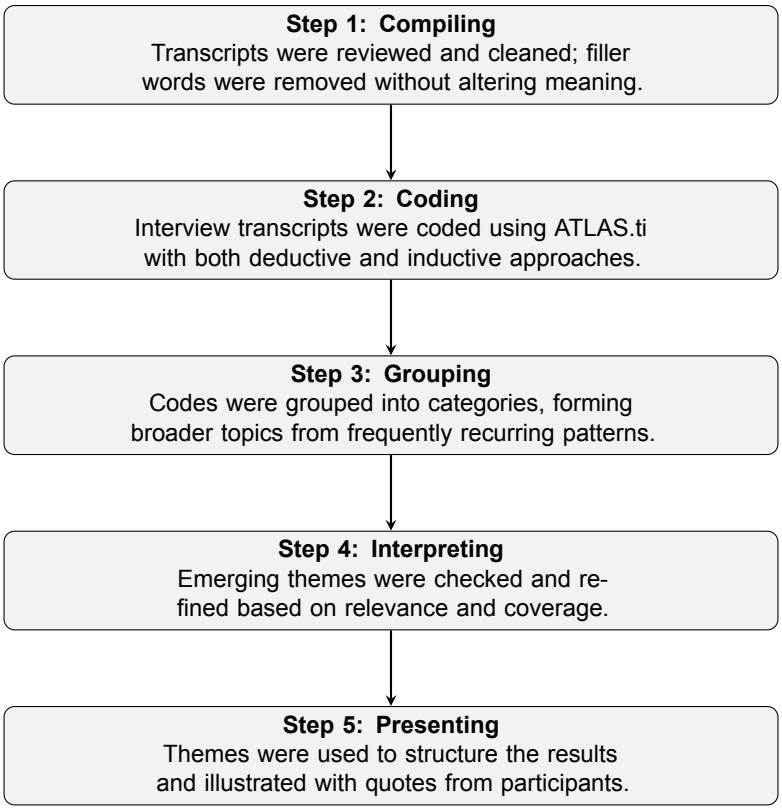

Figure 5.1: Thematic analysis procedure based on Braun and Clarke (2006)

This method allowed the study to remain grounded in empirical insights while also relating findings back to the theoretical framework.

Step 1: Compiling

All interviews were recorded either through MS Teams (for online interviews) or via a smartphone audio application (for in-person interviews). The interviews were then transcribed using the integrated transcription function in Microsoft Word. Although automated tools were used to generate initial transcripts, all transcripts were reviewed manually to ensure accuracy. Filler words and repetitions were removed to facilitate the analysis, while preserving the original meaning and structure of participant responses. Verbatim transcription was applied, capturing participants' answers exactly as stated, rather than summarized, to maintain data richness.

Step 2: Coding

The qualitative data collected through the interviews was coded using the software ATLAS.ti. As Medelyan (2025) defines, "Coding is the process of labeling and organizing your qualitative data to identify different themes and the relationships between them." In this thesis, a combination of deductive (theory- and research-question driven) and inductive (data-driven) coding was employed, allowing for structured yet flexible theme development (Medelyan, 2025).

The initial codebook was developed based on the conceptual framework and literature review. As the interviews progressed, additional codes were added inductively to capture recurring patterns or new concepts. Codes were grouped into two broad categories: (1) circular construction practices in the context of housing associations, and (2) perceived barriers and enablers. Examples of specific codes include "financial constraint," "regulatory gap," "housing urgency," "municipal role," "stakeholder collaboration," and "sustainability ambition."

Step 3: Grouping

Codes that appeared frequently across interviews were grouped into broader themes. These themes were derived in several rounds: first, based on interview recollection and notes; second, from a review of coded transcripts; and finally, by examining the frequency and distribution of codes. The goal was to identify recurring issues, motivations, and decision-making patterns that shape circular construction implementation in housing associations.

Step 4: Interpreting

All coded extracts were read in their original context to check whether the theme truly captured a meaningful pattern related to the research questions. Overlapping themes were merged, overly broad themes were split, and brief working definitions were written for each final theme. At the same time every individual code was checked to ensure it fitted one and only one theme; stray codes were either reassigned or discarded. The result of this step is a concise set of well-defined themes that accurately reflects both sides of the urgency–sustainability tension and the barrier/enabler framework that guides the study.

Step 5: Presenting

The results are presented thematically in Chapter 6. Each subsection reflects one of the core themes mentioned above. Where relevant, direct quotes from interviewees are integrated to support and illustrate the points made. The quotes are anonymized and referenced using interview codes (e.g., SI1, SI2). This approach ensures that the narrative is grounded in empirical evidence while protecting the identity of participants.

6

Empirical Findings

This chapter presents the findings from five semi-structured interviews with managers and policy actors in the Dutch social housing sector. The analysis focuses on the following research task:

- **Sub-question 3** - Which barriers and enablers are most relevant to Dutch housing associations?
- **Sub-question 4** - How do Dutch housing associations navigate the tension between rapid housing delivery and circular construction?

All interviews were coded and grouped into themes using the five-phase thematic-analysis procedure described in Section 5.3. The initial coding template was based on four barrier themes and five enabler themes drawn from the literature review (see Chapter 3), during analysis, additional sub-themes were added where new patterns emerged in the interview data.

The results are organized as follows. Section 6.1 provides an overview of the final theme map and explains the origins of the themes. Sections 6.2 and 6.3 discuss the barrier and enabler themes that interviewees judged most important, supported by direct evidence from the interviews and connected to the broader narrative of ambition, reality, and adaptation in Dutch social housing.

6.1. Overview of Themes

This section synthesizes the interview data into two overarching analytical clusters: barriers and enablers. To maintain coherence with the literature and policy debate, the initial thematic structure was derived from the main categories identified in the literature review (see Chapter 3). However, the actual coding process was both deductive and inductive: while the four *barrier* and five *enabler* themes from literature provided an initial framework, several sub-themes and nuances emerged directly from the interview data. This approach allowed the empirical analysis to both confirm established expectations and capture the lived reality of organizations navigating circular construction in practice.

To answer the research question in a way that reflects real-world complexity, it was important to move beyond simply listing barriers and enablers. Instead, the following sections “tell the story” of how these themes interact in organizational life, how housing associations pursue ambitious circular goals, where those ambitions run into obstacles, and how (or if) they manage to adapt. Whenever possible, interviewees’ own reflections are used to link these themes back to the theoretical framework introduced earlier (see Figure 3.1).

Figure 6.1 and Figure 6.2 give a high-level overview of the frequency with which each theme was mentioned in the interviews. While not statistically representative, these charts help to visualize which types of barriers and enablers dominated the empirical narratives. Each theme is explored in more detail in the following subsections, including examples of how ambitions and day-to-day realities interact, and sometimes conflict, in practice.

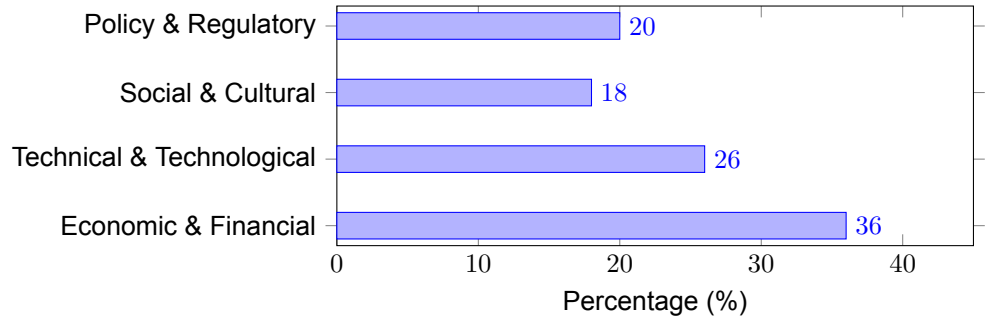

Figure 6.1: Share of interview evidence mapped to the four *barrier* themes.

6.1.1. Barrier Themes

As illustrated in Figure 6.1, the most frequently cited obstacles relate to **economic and financial** challenges (36%). This echoes findings from the literature, but in practice, the interviews brought these issues vividly to life: housing associations consistently described the tension between their ambitions for circular construction and the financial constraints imposed by rent caps, limited margins, and the high up-front costs of non-traditional materials. Several interviewees explained that project ambitions often had to be scaled back when initial cost calculations proved incompatible with organizational budgets or regulatory ceilings. **Technical and technological** barriers (26%) were also a recurrent theme, including limited experience with circular construction, risk aversion to unfamiliar building methods, and the absence of codified standards. While anticipated in the literature, interviewees added concrete stories about stalled pilot projects or difficulties finding suppliers able to deliver circular solutions at scale. **Policy and regulatory** barriers (20%) centered on misaligned planning frameworks, inflexible evaluation tools, and regulatory overload; interviewees frequently linked these obstacles to frustration with the ”rules of the game,” which were seen as lagging behind both sectoral ambitions and the evolving policy landscape. Finally, **social and cultural** factors accounted for 18% of coded references, including internal reluctance, entrenched routines, and a preference for proven (linear) methods. Although less frequently cited than economic issues, interviewees were clear that organizational culture plays a powerful, if sometimes invisible, role in constraining or enabling change. Taken together, these four barrier themes largely confirm the structure and content of the theoretical framework, but the interviews also nuance this picture by highlighting how the barriers often overlap and reinforce each other in daily practice (see Chapter 7).

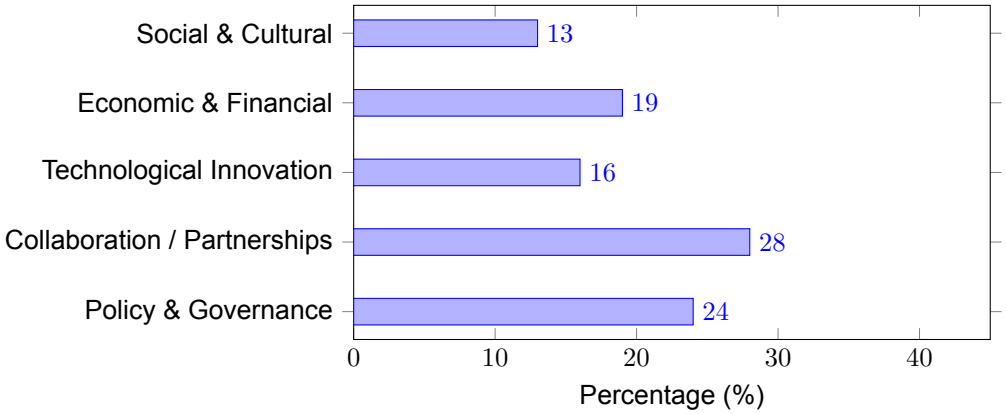

Figure 6.2: Share of interview evidence mapped to the five *enabler* themes.

6.1.2. Enabler Themes

Focusing now on enablers, Figure 6.2 highlights the importance of **collaboration, partnerships, and education**, which made up nearly a third (28%) of all enabling references. Both the literature and interviewees emphasized that early collaboration with partners, such as municipalities, developers, and other housing associations, was essential for learning, risk-sharing, and spreading circular innovation.

Policy and governance mechanisms (24%) were the next most-cited enabler, particularly in relation to supportive land pricing, fast-tracked permitting, and the willingness of some municipalities to experiment with circular criteria; interviewees repeatedly stressed that when policy frameworks are aligned with circular ambitions, organizational change becomes much more feasible. **Economic and financial measures** (19%) and **technological innovations** (16%) followed closely, with interviewees citing targeted subsidies, innovative procurement methods, and digital tools as practical supports. Finally, **social and cultural drivers** (13%), while the smallest category, were often mentioned as essential for achieving a mindset shift and sustaining new routines over time. Although the broad categories of enablers match those identified in the literature, the interviews added detail about how these conditions are created or blocked in practice, and how success often depends on the right combination of enablers working together. This interplay will be explored further in the following sections and will be reflected back onto the initial conceptual framework.

6.2. Barrier Results

This section presents the key barriers to circular construction as identified through the interviews. While circular principles are gaining attention across the Dutch housing sector, the findings reveal that implementation is still constrained by a wide range of practical, financial, institutional, and cultural challenges. To structure this complexity, the barriers have been grouped into the 4 main themes: Economic and Financial, Technical and Technological, Social and Cultural and Policy and Regulatory-related barriers. These categories provide a useful framework to analyze how circular ambitions are hindered in day-to-day project development. The following subsections describe each of the four barrier themes in detail, supported by quotes from the interviews. A final summary figure is included to show how the various sub-themes connect to broader patterns of resistance.

6.2.1. Economic and Financial Barriers

A key challenge for the implementation of circular construction within Dutch housing associations lies in the economic and financial structure under which these organizations operate. While there is growing awareness of the long-term environmental benefits of circularity, interviewees consistently pointed out that financial constraints make it difficult to prioritize these goals in practice.

One of the most direct obstacles mentioned is the higher construction cost of circular materials and methods. For example, timber and bio-based alternatives were often described as significantly more expensive than conventional materials. As one respondent explained: *“Then you see that the price in timber construction... is a bit higher than traditional. Quite a big bit.”* (SI2). Another interviewee stated that even going beyond the legal sustainability requirements tends to increase the total cost of a project: *“For example, if we do more in the area of circularity than we are legally required to do, this will increase costs”* (SI4). These additional costs are often difficult to absorb, especially in the social housing sector where financial margins are already tight.

Closely related to this is the issue of return on investment. Even when circular construction is technically feasible, projects must meet strict financial criteria before they are approved. In one case, a housing association compared traditional and timber construction options. Although timber was preferred from a sustainability point of view, the financial analysis showed it did not meet the organization’s internal return of investment requirements: *“In this case, the timber-framed houses do not meet these requirements”* (SI2). This illustrates how financial tools and benchmarks can directly limit the adoption of circular solutions.

The broader context behind these decisions is shaped by budgetary constraints. Housing associations must fund their projects largely through rental income, which is fixed and relatively low due to the social housing mandate. One respondent described the resulting trade-off clearly: *“With the same pot of money that we have, we can’t build a thousand homes a year. But 800, 700 a year”* (SI1). The same interviewee also noted how the reliance on rents limits room for innovation: *“We have to make do with those rents... and we also don’t want to make things too expensive”* (SI1). This financial pressure creates a preference for familiar, cost-efficient building methods over experimental or circular alternatives.

Furthermore, several interviewees emphasized the strong dependence on loans. Most housing asso-

ciations fund new developments through borrowed capital, often with guarantees. While this allows for large-scale investment, it also imposes clear borrowing limits. One respondent noted: *"We finance everything with loans. So that at the end of ten years you are completely full of loans"* (SI4). This borrowing ceiling becomes particularly problematic when circular projects are more expensive upfront or require longer payback periods.

In projects that involve private developers, additional barriers appear. Developers typically aim to maximize profit and are often unwilling to invest in circular design unless it directly improves their financial return. As one interviewee explained: *"And then they say: can you take that 30%, just buy it turnkey. Then it's simply the product the developer is offering. And we can come up with all kinds of requirements, but then he says: that's not the product I'm offering you."* (SI3). This commercial logic can clash with the longer-term and less tangible benefits of circular construction, especially in joint development projects.

Another financial barrier relates to the short-term focus of financial models. Standard tools such as cost-benefit spreadsheets or investment analyses often operate on time horizons of 30 to 50 years, whereas circular benefits, such as reuse, modularity, or material value recovery, may only become relevant after 70 or even 100 years. As one municipal actor observed: *"We all work with spreadsheets... but the actual lifespan is much longer. One of the bottlenecks is simply the limited time horizon of those spreadsheets"* (SI5).

In addition, several respondents noted a lack of priority for circularity at the municipal level. While sustainability is often included in policy documents, municipalities tend to focus on building as many homes as possible, as quickly as possible. This translates into a low willingness to invest in or demand circularity when it might delay delivery. One respondent put it plainly: *"The municipality is really putting pressure on the housing associations. Like: come on, stay on track, keep up the pace. We want it to be delivered quickly."* (SI2).

Finally, some interviewees raised concerns about the financial uncertainty surrounding the reuse of circular materials and components. Because many of these practices are still relatively new, there is little experience with how cost-effective reuse will be in the long term. One respondent expressed this clearly: *"And is it still cost-saving to reuse it? Or is it perhaps more expensive? We have zero experience with that"* (SI4). This lack of precedent makes it difficult for housing associations to evaluate the financial viability of circular strategies compared to more established, linear approaches.

6.2.2. Technical and Technological Barriers

In addition to financial concerns, several interviewees highlighted concrete technical and technological obstacles that hinder the implementation of circular construction in day-to-day practice. These challenges often arise well before construction begins, influencing decisions in the early phases of design, procurement, and project planning.

One of the most consistently mentioned issues was the limited technical knowledge within project teams regarding circular or bio-based construction systems. Most organizations continue to rely on conventional building methods such as concrete and brick, which are well understood and widely practiced. As one respondent explained: *"For example, if you want to try something, I don't know, a kind of timber frame construction, there's just less knowledge about that. Whereas if we stick to something conventional, with a foundation and concrete and we just build it up… well, that's been done quite often in this country."* (SI1). This lack of familiarity reinforces a preference for traditional solutions that align with available expertise.

Closely tied to this is a sector-wide aversion to technical risk, with several respondents referring to the importance of making "no-regret" decisions. Circular and bio-based approaches are still perceived as uncertain, and the lack of long-term performance data makes many actors reluctant to adopt them. One interviewee illustrated this attitude clearly: *"You also want to make no-regret decisions. That you don't think, if only I had built something else, then it's all very difficult to adjust"* (SI4). This cautious mindset slows the pace of innovation, as housing associations often wait until new techniques have been proven safe and reliable.

Another significant barrier is the absence of codified standards for circular or reused materials. Because

these materials are not yet widely adopted, they often fall outside established design and procurement frameworks. This leads to added complexity and resistance within project teams. As one respondent noted: *"Suppose we now want to standardly install windows made from reused glass or salvaged from demolished homes - then you'd have to reorganize the entire organization to make that happen"* (SI3). Without more consistent standards and streamlined processes, circular construction remains difficult to scale beyond a handful of dedicated projects.

A broader and more systemic issue mentioned by interviewees is the general lack of experience with circular construction across the sector. While interest has grown, most housing associations are still in an early learning phase, lacking hands-on knowledge of circular methods and their outcomes. As one respondent admitted: *"And is it still cost-saving to reuse it? Or is it perhaps even more expensive? We have zero experience with that"* (SI4). This uncertainty hampers decision-making and makes it difficult to embed circular principles into standard procedures.

Finally, although many organizations are experimenting with pilot projects, these efforts tend to remain fragmented and isolated. There is no national platform or coordination mechanism to facilitate systematic knowledge exchange. As one respondent pointed out: *"If a housing association does a pilot project... it's not necessarily the case that all the lessons learned there... are shared"* (SI2). As a result, organizations often repeat the same challenges instead of building on each other's experiences, limiting both the speed and impact of circular innovation.

6.2.3. Social and Cultural Barriers

Besides financial and technical constraints, several interviewees described a set of barriers that are more social and cultural in nature, particularly within and between organizations. These barriers do not stem from a lack of awareness about circularity, but rather from habits, internal culture, institutional inertia, and conflicting priorities in professional practice. As such, they often act as more subtle forms of resistance to change, even in organizations that support sustainability in principle.

A common issue raised was risk aversion within organizations. Several respondents noted that housing associations and their project partners tend to prefer "safe" or familiar solutions, partly due to the pressure to deliver housing quickly and efficiently. This leads to a reluctance to take the lead on experimental or circular projects, unless others have already shown that it works. One respondent described this tendency clearly: *"The construction sector is still quite conservative. bio-based materials like wood are only used occasionally — concrete and brick remain the standard"* (SI5). This cautious attitude reflects a broader preference for proven methods over innovation, especially when technical, financial, or organizational risks are involved.

In addition to risk aversion, respondents also pointed to internal reluctance or a lack of shared urgency within their own organizations. While circularity may be part of long-term strategies or policy documents, not everyone in the organization is equally motivated to act on it in practice. One respondent described how this plays out in day-to-day projects: *"So we have to approach the project differently than we're used to. That brings several challenges, which also makes it more difficult and time-consuming"* (SI3). In such cases, circularity risks being treated as an optional add-on, rather than a guiding principle.

A further barrier described by multiple respondents is the public focus on speed and quantity over sustainability, particularly from municipalities. This pressure to build quickly and at scale can crowd out attention for longer-term goals like circularity. One interviewee noted: *"The municipality is really putting pressure on the housing associations. Like: come on, keep up, pick up the pace. We just want it to be completed quickly"* (SI2). While sustainability may be present in policy documents, the dominant narrative in practice is often about delivery volume and speed.

Another key issue mentioned by interviewees was the lack of coordination and clear division of roles between stakeholders. Circular ambitions often fall between the cracks of different organizations, such as municipalities, housing associations, commercial developers, and construction firms—each with their own timelines, goals, and procedures. This complexity creates confusion, slows down decision-making, and makes it difficult to prioritize circularity. One respondent illustrated this vividly: *"So you've got the municipality on one side… and the Housing Association on the other… and sometimes a commercial party as well. Each of them puts forward their own demands, sometimes overlapping, sometimes conflicting. And the developer has to deliver on all of them. On top of that, you also need approval from all*

sorts of separate departments. These two are like many-headed monsters" (SI1).

6.2.4. Policy and Regulatory Barriers

While interviewees generally recognized that circular construction aligns with long-term policy ambitions in the Netherlands, they also described several policy and regulatory barriers that hinder its implementation in practice. These challenges do not always stem from the absence of policy, but often from misalignment, rigidity, or ambiguity in existing instruments.

One of the most frequently mentioned obstacles was regulatory misalignment, particularly between spatial planning frameworks and the technical assessment of innovative design proposals. In several cases, circular building concepts conflicted with existing local guidelines or zoning constraints, resulting in delays or the need for redesigns. One respondent described this process: *"The design has already been rejected a few times — either it turned out to be very expensive, or it was rejected because of spatial planning frameworks. That it didn't fit the surroundings. And now there's the new environmental vision as well"* (SI4). This illustrates how even when not directly prohibitive, regulatory frameworks can inadvertently obstruct circular practices.

Another important theme was the misalignment between long-term sustainability ambitions and short-term planning pressures. Both housing associations and municipalities often face significant urgency to deliver housing rapidly, which favors conventional, risk-averse approaches. As a result, circular strategies, particularly those that are experimental or require longer timelines, are often deprioritized. One interviewee expressed this trade-off explicitly: *"I think having a roof over your head is more important than having a sustainable roof over your head. Personally, I would say: all efforts should go toward expansion first. As quickly as possible. And the sustainability can come later"* (SI4). This sentiment underscores how immediate housing needs can crowd out opportunities for long-term circular innovation.

In addition, interviewees pointed to the rigidity of national modeling tools and evaluation criteria as a barrier. Instruments used to assess project viability, such as spreadsheet-based financial models, tend to focus on short- or medium-term outcomes, without adequately accounting for the longer life cycles and reuse potential that circular construction entails. While current structures may not fully support circularity, some respondents perceived a shifting cultural mindset. As one municipal actor observed: *"I hope not, but to be honest, I do expect it. Still, I think the societal undercurrent we're seeing — that's a whole different conversation — is that there's growing attention to climate change and increasing awareness about how we use our resources and those kinds of things"* (SI5).

Ambiguity around institutional responsibilities also emerged as a notable concern. Interviewees were often unclear about who should lead circular initiatives: municipalities, housing associations, or private developers, and at what stage each actor should be involved. One respondent noted: *"To ensure that we as housing associations are involved early in the planning phase - in the past, that hasn't always been the case. And we still find that it can be difficult at times"* (SI3). Another added: *"The question is whether you should realize all of this through housing associations, or partly through the market"* (SI4). This lack of clarity slows down collaborative processes and complicates decision-making in complex development contexts.

Finally, the issue of regulatory overload, or goal-stacking, was raised by multiple respondents. Although most regulations aim to achieve important societal objectives, the sheer accumulation of demands around sustainability, affordability, spatial quality, and more can ultimately hinder progress. As one interviewee put it: *"We keep emphasizing: don't stack all the regulations. Because then no housing will get built, and we certainly won't achieve anything extra in terms of sustainability"* (SI4). Another shared a similar frustration: *"We've made things so complex that we can't get them off the ground anymore"* (SI2). These reflections reveal how even well-intentioned regulations can, in aggregate, create excessive complexity and delay circular ambitions.

6.3. Enabler Results

While much of the discussion around circular construction has focused on the obstacles that prevent its widespread adoption, the interviews conducted for this research also highlighted a variety of enabling conditions. These enablers, ranging from supportive governance structures to emerging technological

innovations, illustrate that, despite institutional and financial constraints, there is growing movement toward more circular approaches in Dutch housing projects. This section presents the most significant enablers identified by the interviewees, organized around five interrelated themes: policy and governance, collaboration and partnerships, technological innovations, economic and financial solutions, and social and cultural drivers. Each theme reveals how certain conditions can facilitate circular ambitions, reduce perceived risks, and help translate sustainability goals into practice.

6.3.1. Policy and Governance

While policy misalignment and regulatory overload were often cited as barriers, several interviewees also identified enabling factors within the policy and governance context. These enablers are typically related to strategic direction-setting, public procurement influence, and the role of municipalities as coordinators or initiators.

A key enabling role is played by municipalities that explicitly prioritize circularity in their development strategy. By incorporating circular objectives into tender requirements, environmental visions, or housing programs, they create an institutional environment where circular solutions are not only permitted but actively encouraged. One respondent noted: *"We see it as the role of government to temporarily act as a driver in this area"* (SI5). This reflects a governance approach in which municipalities lead the transition by shaping early market demand and signaling long-term commitment.

Municipal policy frameworks can also provide clarity and consistency in decision-making. When local environmental goals are well integrated into spatial planning or permitting processes, housing associations experience fewer delays and have more certainty to invest in circular options. As one respondent from a housing association put it: *"When the municipality explicitly asks for bio-based or circular, then that really helps us to get it off the ground"* (SI2). This kind of alignment across public actors was repeatedly mentioned as an essential condition for successful circular projects.

Another important enabling factor is the use of public land ownership to steer development. In several interviews, municipalities were described as using their position as landowners or facilitators to enforce or incentivize circular building. This was particularly relevant in projects where the municipality retained a coordinating role or owned part of the land. One interviewee explained: *"Then we had the land in our hands, and we could make demands. That helped to push circularity further than usual"* (SI5). This indicates that policy influence is strongest where public actors combine regulatory tools with spatial or financial leverage.

Finally, some interviewees observed that the wider policy narrative around climate adaptation and resource efficiency is gradually shifting in favor of circular construction. National policy ambitions, though not always directly operational, were seen as providing legitimacy for local experiments and investment. While this broader policy environment does not remove practical challenges, it does create political cover and motivation for organizations willing to take the lead.

6.3.2. Collaboration / Partnerships

In addition to institutional support and policy frameworks, several interviewees highlighted the importance of collaboration and knowledge development as enabling conditions for circular construction. These enablers are rooted in everyday practice and rely less on formal rules than on relationships, shared learning, and professional development across organizational boundaries. Especially in a context where circular construction is still emerging, collaboration and education were seen as essential to building trust, reducing perceived risk, and increasing internal confidence.

A frequently mentioned theme was the value of working together across organizations. Housing associations, municipalities, and private partners often face similar uncertainties around circular design, materials, and performance. Joint pilots or knowledge-sharing initiatives can lower the threshold for trying something new. As one interviewee explained: *"We're trying to do more and more with circularity step by step. Start small, learn through projects. And little by little move towards one hundred percent circular"* (SI3). Another respondent emphasized how this collaborative approach is organized in practice: *"For example, we have pilots in the area of circular construction. We have pilots around allocating housing differently. We have pilots focused on more chain-oriented sustainability. So we divide the themes a bit and share our experiences with other housing associations"* (SI4). This incre-

mental, peer-supported learning process allows organizations to experiment safely and build up internal support through practical experience.

6.3.3. Technological Innovations

Despite the technical uncertainties described in earlier chapters, several interviewees pointed to emerging technological developments as important enablers of circular construction. These innovations help to reduce the perceived risk of experimentation, improve confidence in bio-based or demountable solutions, and provide concrete tools to translate circular ambitions into buildable designs.

A recurring theme was the growing familiarity with timber construction and other bio-based systems. Although these methods are still less common than conventional techniques, respondents noted that they are no longer seen as radical or unproven in every case. In certain projects, timber was chosen not only for environmental reasons but also because it offered specific technical advantages. One interviewee explained: *"It's timber because there's a parking garage underneath. That means you have to build lightweight"* (SI4). In this case, material selection was guided by structural necessity, but it also helped to normalize the use of circular materials. Examples like this show how technical constraints can align with sustainability goals when the right solutions are available and well understood.

Another important enabler mentioned by several interviewees was the increasing maturity of modular and industrialized construction methods. These systems, often produced off-site in factory settings, offer significant potential for circular construction due to their use of uniform components, repeatability, and ease of assembly and disassembly. As one respondent explained: *"Industrialized construction means that everything is made in a factory and then assembled on-site. That automatically makes it modular, because they're usually just modules produced in a factory. [...] You increasingly see that homes are assembled on-site from fixed components"* (SI3). This shift toward modularity reduces the need for bespoke technical solutions and lowers the threshold for implementing circular principles.

Finally, an interviewee similarly pointed to modular housing as a key area of innovation: *"I think we need to put much more focus on modularly built homes. These are innovations that can really have a big impact on circular construction"* (SI3). These reflections suggest that technological progress, particularly in the form of industrialized, prefabricated, and demountable systems, is helping to make circular construction more accessible and scalable. As such methods become more widely accepted and commercially available, they enable housing associations to embed circularity into mainstream development without needing to reinvent the process for every project.

6.3.4. Economic and Financial Solutions

While economic constraints were often described as major barriers to circular construction, several interviewees also identified enabling financial mechanisms and shifting cost perspectives that can support circular strategies. These enablers relate to how costs are understood, managed, and distributed, and how financial decisions are shaped by broader sustainability goals and risk assessments.

Perhaps the most frequently stressed (financial) enabler across the interviews was the need for additional government funding to support circular construction. Because circular methods often involve higher initial costs, longer returns on investment, or increased complexity, housing associations stressed that they cannot bear these risks alone. Several respondents argued that public support, whether through targeted subsidies, land price reductions, or national innovation funds, is essential to make circular building financially viable. One respondent was clear: *"If you really want to take circular construction seriously, you simply have to add money. Otherwise you won't make it profitable"* (SI1). Without structural financial support, circular ambitions risk being sidelined in favor of more conventional, cost-efficient solutions. This shows that public co-investment is not just helpful but necessary if the sector is to scale up circular practices and move beyond isolated pilots. It highlights the enabling role governments can play, not only through regulation or procurement policy, but also by sharing the financial responsibility of transitioning to more sustainable building models.

One important enabler mentioned in the interviews is the growing awareness that financial models need to reflect the long-term value of sustainable and circular construction. While traditional costing tools often prioritize short payback periods and lower initial investments, some respondents stressed that this approach can undervalue quality and durability. A municipal official illustrated this clearly: *"I*

believe you should build for quality. You don't build a house for 30 years - ideally, you build it for 80, 90, maybe even 100 years. But the benchmark is set by a spreadsheet that only looks 30 years ahead" (SI5). By relying on models that only calculate over a limited time horizon, current decision-making structures fail to fully account for lifecycle benefits such as lower maintenance costs, adaptability, or material reuse. The same respondent argued that simply extending these models could unlock greater investment room for circular projects: *"Quite simply, if you can extend the spreadsheet, it means you can carry a higher investment burden now. And I am convinced that doing so would increase your investment capacity"* (SI5). This suggests that updating financial assessment tools to reflect longer-term horizons could play a significant role in enabling circular construction within the public housing sector.

Several interviewees also described how public funding or sustainability-linked subsidies can help de-risk circular projects. While such instruments are not always readily available, their presence can shift the financial calculus in favor of more ambitious design choices. In some cases, additional funding was secured through provincial or national programs that prioritize innovation or bio-based materials. Even when modest in size, these funds were seen as helpful in overcoming internal resistance to higher upfront costs.

Another financial enabler lies in the evolving expectations of municipalities as landowners or project facilitators. When municipalities allow housing associations more flexibility in how they meet sustainability objectives, such as through flexible tendering processes, this can create room to prioritize circular strategies within the available budget. One respondent reflected positively on such an approach in Apeldoorn: *"Instead of saying: you have to score the highest on every point, they say: well, you can make some concessions on that in total, if you score the highest on that"*(SI2). Instead of enforcing rigid criteria on all sustainability aspects, this model allows associations to shape their own priorities and be assessed on the overall result. This kind of institutional flexibility can help make circular ambitions more financially and practically feasible within project development.

Finally, some respondents pointed out that as circular methods become more common, their cost premium is likely to decrease. With growing market maturity, development of uniform methods, and better availability of bio-based materials, it becomes easier to budget, compare, and justify circular alternatives. While this development is still in progress, it signals a structural shift toward more financially viable circular construction.

6.3.5. Social and Cultural Drivers

Although social and cultural factors were often framed as barriers to circular construction, several interviewees also highlighted emerging cultural shifts, internal motivation, and growing societal awareness as important enablers. These drivers may not always be formalized or measurable, but they play a significant role in shaping how circularity is perceived, legitimized, and implemented within organizations and across the housing sector.

A number of respondents described a gradual change in organizational mindset. Even in contexts where circularity is not yet structurally embedded, there appears to be growing openness to experimentation and a willingness to learn through practice. This shift was especially visible in teams that had previously worked on sustainability-related initiatives, where experience with the energy transition or low-carbon materials created a foundation for engaging with circular approaches. As one respondent put it: *"There is definitely curiosity within housing associations. We still want to do a few projects, even though they are less profitable... or don't fully meet our own internal requirements. Just to learn from them"* (SI2). The cumulative effect of these smaller steps was seen as contributing to a broader cultural change, in which circularity becomes less of a niche topic and more of a shared organizational ambition.

Another important social enabler mentioned in the interviews was the increasing public and political attention to climate change and resource use. While this awareness does not always translate directly into circular mandates, it creates a normative context in which sustainability is more widely expected. One municipal respondent observed: *"The societal undercurrent we have is that there's growing attention to climate change and increasing awareness about how we use our resources and that sort of thing"* (SI5). This broader shift in values strengthens the position of those advocating for circular

strategies within their organizations and encourages a more forward-looking mindset.

In addition, the rise of professional networks and working groups focused on circularity was seen as a helpful development. Several interviewees noted that participation in sector-wide platforms or thematic collaborations enabled them to exchange knowledge, share lessons learned, and build confidence. While often informal, these forms of peer learning contributed to a sense of shared purpose and made it easier to promote circularity internally. Together, these cultural drivers support the diffusion of circular ideas and create the institutional space needed to turn ambition into action.

7

Bridging the Gap

This chapter interprets the empirical findings in relation to the theoretical concepts introduced earlier in the thesis. It aims to combine insights from both literature and practice in order to understand how Dutch housing associations overcome the challenges of circular construction in urgent housing projects. This analysis addresses Sub-question 5:

- **Sub-question 5** - What strategies can help housing associations overcome circularity barriers?

The chapter is structured into three main sections. Section 7.1 presents a comparative analysis that contrasts the barriers and enablers identified in the literature with those emerging from the interviews. Section 7.2 then proposes a strategic pathway framework, outlining how housing associations could develop capacity, adjust performance logic, and build collaborative ecosystems to support circular construction. Finally, section 7.3 offers a validation of the findings through expert feedback from Aedes.

7.1. Comparative Analysis

This section presents a comparative analysis, contrasting the theoretical understanding of circular construction, as established in the Literature Review (Chapter 3), with the empirical findings derived from interviews with Dutch housing association practitioners (Chapter 6). The thematic analysis of interview data was initially guided by categories identified in the literature, facilitating a structured discussion of convergences, divergences, and nuanced perspectives emerging from practice.

7.1.1. Barrier Identification

The empirical data largely confirmed the primary categories of barriers to circular construction outlined in the literature: economic and financial, technical and technological, social and cultural, and policy and regulatory. The interview data, however, provided crucial contextual emphasis, detailing how these barriers manifest specifically within the operational realities of the Dutch social housing sector.

While the literature comprehensively documents economic and financial barriers (Guerra & Leite, 2021; Huang et al., 2018), the interviews consistently highlighted their acute and immediate impact. Practitioners articulated how the high up-front costs associated with circular materials and methods directly conflict with the financial regime of social housing, characterized by rent controls and WSW borrowing limits. This frequently necessitates a reduction in the scope of circular ambitions, a practical repercussion that receives less focus in broader academic discussions. The constraints imposed by short-term financial models, noted by Carra and Magdani (2017), were reported as a significant practical obstacle to justifying long-term circular investments.

Concerning technical and technological barriers, practitioner experiences corroborated literature findings on issues such as the absence of codified standards for circular methods and insufficient experience (Charef & Lu, 2021; Ghisellini et al., 2018). The interviews provided substantive accounts of the consequences, including stalled pilot projects and difficulties in sourcing circular solutions at scale.

Furthermore, a pronounced risk aversion towards unfamiliar methods, leading to ”no-regret” decision-making, was a notable theme arising from practice.

The literature identifies social and cultural barriers, including resistance to established norms and inadequate awareness (Charef, Morel, & Rakhshan, 2021; Hart et al., 2019; Kirchherr et al., 2018). Interviews confirmed these elements but also emphasized the significant influence of external pressures, particularly the municipal emphasis on the speed and volume of housing delivery, which can subordinate circularity objectives. The challenge of coordinating diverse stakeholder interests, described by one interviewee as navigating a ”many-headed monster,” illustrated a practical complexity often discussed more generally in the literature.

Finally, regarding policy and regulatory barriers, the issues of inconsistent or misaligned regulations noted by Rios et al. (2021) were strongly affirmed. The empirical data distinctly captured a practitioner sentiment that the existing regulatory framework often ”lags behind” sectoral ambitions and contributes to ”regulatory overload,” thereby impeding rather than facilitating innovation.

A critical insight from the interviews, which adds a layer of complexity to the literature’s thematic organization, was the interconnectedness of these barriers. Practitioners frequently described how financial limitations could intensify technical risk aversion, or how regulatory challenges could undermine collaborative initiatives, forming a complex matrix of reinforcing obstacles.

7.1.2. Enabler Identification

Similarly, the principal enabler categories identified in the literature, policy and governance, collaboration and education, technological innovations, and social/cultural drivers, were all validated as relevant by the interviewees. The empirical data, in this domain as well, offered important clarifications on their practical application and perceived impact.

The importance of collaboration, partnerships, and education, well-established in the literature (Charef, Ganjian, & Emmitt, 2021; Hill, 2015), was strongly underscored by practitioners. They emphasized the instrumental value of early co-design processes, peer-to-peer learning through shared pilot project experiences, and broader knowledge dissemination for building institutional confidence and mitigating the risks associated with circular construction.

Regarding policy and governance mechanisms, while literature advocates for supportive frameworks (Acharya et al., 2018), practitioners highlighted the substantive impact of proactive municipal engagement. Specific instruments, such as strategic land pricing, expedited permitting for circular projects, and a clear coordinating role for local authorities, were identified as potent practical enablers.

One of the most significant points of emphasis from the empirical findings concerns economic and financial enablers. Although the literature discusses various financial incentives, practitioners consistently stressed the critical need for direct government financial support and co-investment. This was positioned not merely as beneficial, but as an essential prerequisite for scaling circular construction beyond isolated pilot projects, given the inherent financial structure of the social housing sector. The necessity of adapting financial models to adequately reflect long-term value, as proposed by Adams et al. (2017), was also a frequently expressed viewpoint.

For technological innovations, interviews confirmed the relevance of tools such as BIM and Design for Disassembly discussed in the literature (Tingley et al., 2018). Practitioners reported increasing familiarity and improved accessibility for specific technologies, particularly timber construction and modular/industrialized building systems, indicating these are transitioning from theoretical possibilities to viable operational pathways.

Finally, social and cultural drivers, including public education and leadership (Osei-Tutu et al., 2022), were recognized as pertinent. The interviews suggested a gradual evolution in organizational mindset and noted the enabling influence of growing public and political attention to climate and resource issues, which provides a supportive, albeit not always direct, stimulus for change.

Consistent with the barriers, interviewees often indicated that the efficacy of enablers is magnified when they operate in synergy. For instance, supportive policy measures yield greater results when complemented by robust collaborative networks and appropriate financial backing.

7.2. Pathway Frameworks

This section presents the analytical framework used to interpret how Dutch housing associations might navigate the complex transition toward circular construction. Building on the conceptual framework outlined earlier, this analysis systematically draws on insights from the literature review on circular construction, public value conflicts, and organizational change in the built environment. The purpose is to identify practical levers, common barriers, and potential pathways for embedding CE principles in the Dutch housing sector. These three strategic pathways: developing circular expertise, Redesigning Business Model, and building market supply are illustrated in Figures 7.1, 7.2, and 7.3, respectively.

7.2.1. Connection of Frameworks

The pathway framework is directly grounded in the system-level perspective established in the conceptual framework, which mapped the simultaneous pressures for rapid, affordable housing delivery and the fulfillment of long-term sustainability and circularity goals. It also outlined the internal and external constraints shaping organizational decision-making in Dutch housing associations.

From both the literature review and the empirical findings, three strategic pathways emerge as central to embedding circular construction in Dutch housing associations. These pathways address different leverage points in the sector and are grounded in the challenges and solutions articulated by interviewees:

A. Developing Circular Expertise: fostering circular knowledge, skills, and adaptive routines within housing associations. This involves moving from fragmented, small-scale pilots toward mainstreamed organizational learning and embedded circular practices, supported by targeted training, collaborative knowledge exchange, and internal culture shifts.

B. Redesigning Business Model: reforming financial models and project appraisal practices to account for the long-term, life-cycle benefits of circular construction. This pathway addresses the misalignment between short-term, output-based assessment and the value creation of circular strategies, enabling the sector to unlock finance and support for circular projects.

C. Building Market Supply: advancing toward sector-wide adoption of circular methods by aligning ambitions, aggregating demand, and establishing collective procurement and developing uniform circular requirements across housing associations. This pathway emphasizes the need for collaborative structures, joint market engagement, and coordinated efforts to achieve economies of scale, lower costs, and establish circular construction as a new standard.

These pathways do not operate in isolation, but address different aspects of the Capacity-Circularity Gap identified in both the literature and the context study. The literature indicates that single interventions, such as adopting a new technical solution or implementing a pilot project, are rarely sufficient on their own, due to persistent sectoral and organizational barriers. Instead, progress depends on a coordinated approach that simultaneously targets knowledge, financial models, and collaborative processes.

By synthesizing general insights from the literature and applying them to the specific operating environment of Dutch housing associations, this framework provides the basis for interpreting empirical findings and formulating context-appropriate recommendations for policy and practice.

7.2.2. Developing Circular Expertise

The interview findings reveal that a key challenge for Dutch housing associations in advancing circular construction is the current lack of organizational expertise with circular principles and practices. This knowledge gap was consistently linked to several technical, cultural, and institutional factors that together make it difficult for associations to move beyond conventional, linear approaches. This development is visualized in Figure 7.1, which outlines how housing associations can move from fragmented experimentation to embedded organizational learning.

Many interviewees described how limited familiarity with circular construction methods, such as biobased materials, modular systems, or reusable components, creates uncertainty and reinforces risk-averse decision-making. This technical uncertainty is further compounded by a sector-wide preference for tried-and-tested construction techniques, with most organizations relying on established routines and

familiar supply chains. As a result, there is often little incentive to experiment with circular solutions, especially in contexts where speed and cost control are dominant priorities.

The empirical data also show that circular expertise is not yet embedded in the day-to-day processes of most housing associations. Instead, learning about circular approaches typically takes place through isolated pilot projects or through informal exchange of experiences with peers. These efforts, while valuable, are often fragmented and lack a coordinated strategy for scaling up knowledge across the organization or sector. The absence of structured knowledge exchange mechanisms means that lessons learned from pilots are not always systematically shared, leading to duplication of efforts and a slow pace of organizational learning.

Despite these barriers, the interviews also point to a rising understanding of the importance of developing internal circular expertise. Several respondents highlighted the role of collaboration and peer learning in building confidence and reducing perceived risks. Initiatives such as joint pilots, working groups, and cross-organizational learning sessions were mentioned as practical ways to build up knowledge and to normalize the use of circular methods within project teams. Over time, these processes can help shift internal mindsets and create a culture that is more open to experimentation and continuous improvement.

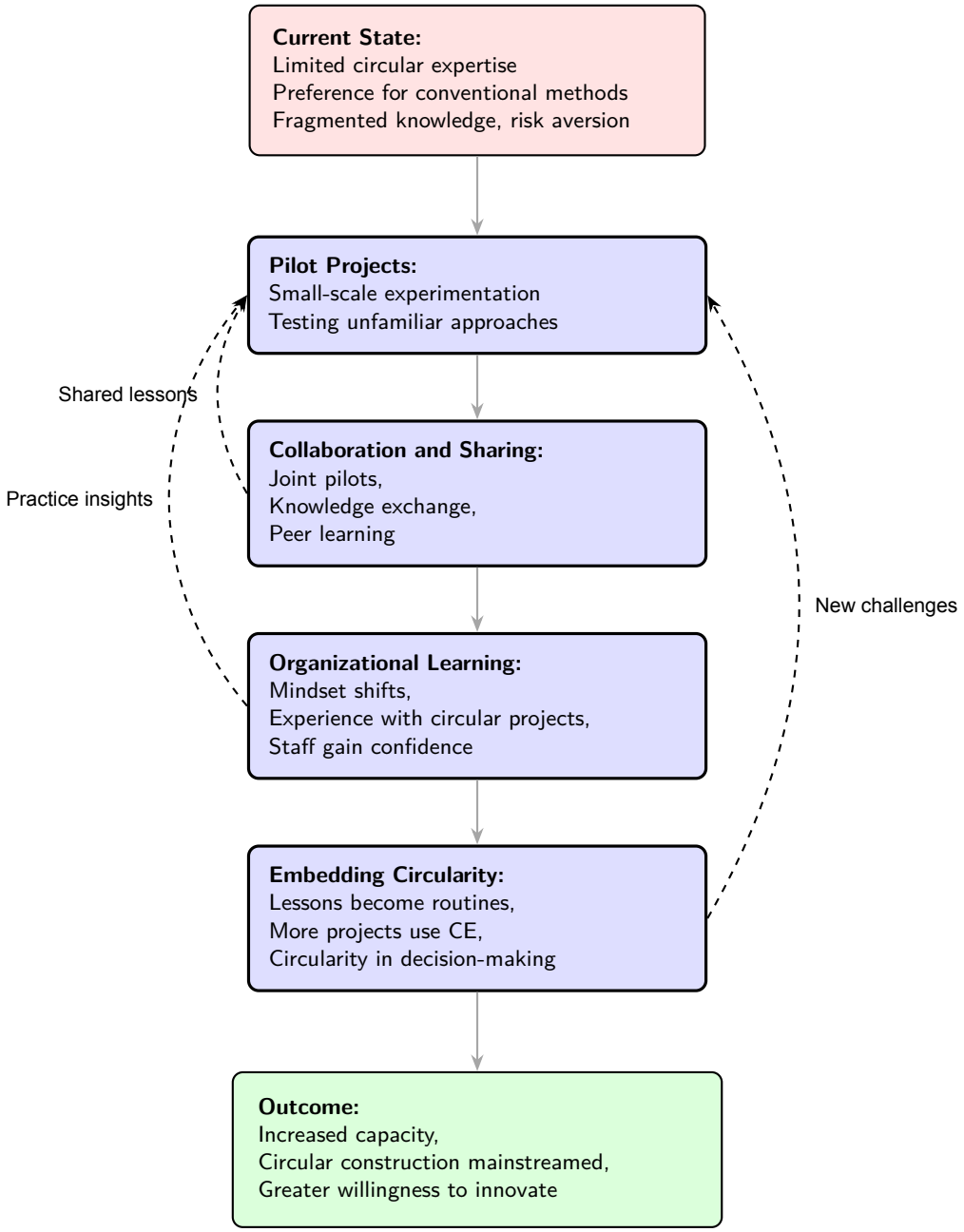

Figure 7.1: Pathway A

7.2.3. Redesigning Business Model

A central barrier identified in the interviews is the misalignment between current performance metrics and the value creation logic of circular construction. The stepwise transition from short-term cost logic to a funding model that values circularity is illustrated in Figure 7.2. Across the Dutch social housing sector, housing associations are required to assess project viability using conventional financial models, primarily cost-benefit analyses and investment spreadsheets that focus on a 30-50 year horizon. As respondents explained, these models are integral to securing loans from banks or sectoral guarantors, and are often embedded in both municipal tendering and internal decision-making processes.

However, the data reveal that the benefits of circular construction, such as extended building lifespans, future reuse, reduced maintenance, and long-term social or environmental value, mostly fall outside this conventional assessment window. Several interviewees pointed out that this temporal mismatch has concrete financial consequences: when circular solutions incur higher up-front costs but yield savings or flexibility only in later decades, they are systematically undervalued. As a result, even motivated associations find it difficult to justify or finance circular strategies, since the required funding cannot be secured based on existing models. This creates a structural exclusion of circular options from mainstream project pipelines.

The pathway to overcoming this barrier, as suggested in the interviews, begins with sector-wide recognition of the so-called “horizon gap.” Respondents from both housing associations and municipal partners described growing awareness that their funding and appraisal logic does not capture the full range of circular benefits. This awareness often emerges from internal discussions, benchmarking exercises, or frustration when promising circular concepts are excluded from development portfolios due to their perceived unviability.

The next step involves deliberate stakeholder dialogue. Interviewees noted the importance of convening funders (such as WSW), policymakers, and sectoral partners to explicitly discuss the limitations of current performance frameworks. This dialogue opens the door for experimentation, with some associations piloting new forms of assessment that extend the time horizon, incorporate life-cycle costs, or attempt to value reuse and adaptability more systematically.

According to the data, these pilots are essential for building an evidence base. By tracking actual maintenance costs, tenant satisfaction, or realized material reuse, associations can demonstrate that circular projects may deliver better long-term outcomes than initially expected. This practical evidence helps convince both internal and external decision-makers, including lenders and regulators, of the value in shifting assessment criteria.

As more pilots deliver positive results, the sector gains leverage to advocate for adjustments to funding requirements. Respondents described ongoing efforts to persuade financial institutions and regulatory bodies to adopt broader assessment criteria, including life-cycle performance, adaptability, and environmental returns. When these adjustments are institutionalized, either through updated loan requirements, new municipal tender rules, or revised sector guidelines, circular construction becomes financeable at scale.

The final outcome, reflected in both the interview data and the stepwise figure (Figure 7.2), is a funding and performance logic that is genuinely aligned with circular principles. This allows housing associations to invest in circular strategies without sacrificing financial viability, enabling broader adoption and fostering the long-term shift from linear to circular construction. Feedback loops, where updated metrics lead to new rounds of evidence and policy refinement, support continuous improvement and reinforce the institutional legitimacy of circular approaches.

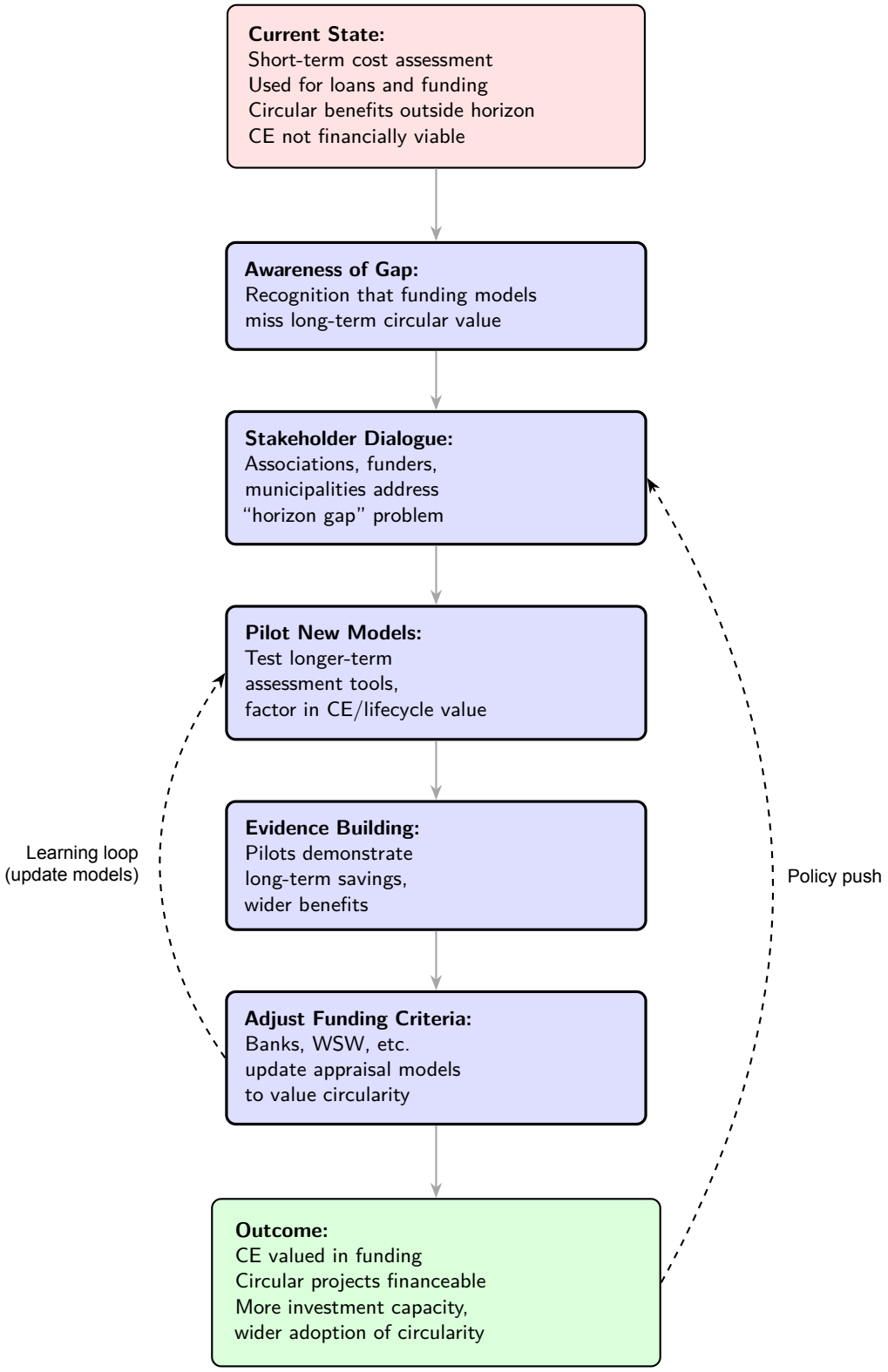

Figure 7.2: Pathway B

7.2.4. Building Market Supply

The empirical findings show that the journey toward scaling of circular construction practices within Dutch housing associations begins with recognizing shared ambitions and overcoming fragmentation. Despite a growing awareness of the need for circularity, interviewees consistently described how isolated project demands and differing organizational priorities keep market incentives weak and prevent sector wide change. Figure 7.3 illustrates this pathway toward aggregated demand, market alignment, and eventual eventual scaling of circular solutions.

The first critical step is the alignment of ambitions among housing associations. Through regular exchange of lessons learned and networking, associations become aware of their common goals and the limitations of individual action. The interview data reveal that this peer learning and strategic dialogue lay the foundation for more coordinated approaches.

As more associations begin to incorporate CE requirements into their project briefs and procurement processes, the collective demand for circular solutions becomes clearer and more predictable. This emerging joint demand signals to market parties, such as developers, manufacturers, and contractors, that there is a genuine and growing need for circular products and services. Respondents in the interviews noted that such demand aggregation is essential to overcoming current supply bottlenecks and to motivating the market to invest in new solutions.

A pivotal phase in the pathway is volume aggregation. By synchronizing procurement cycles and pooling project volumes, housing associations are able to jointly approach the market with a consolidated and sizable demand. This not only enhances their bargaining position but also mitigates risk for suppliers, making it more attractive for them to scale up the production of circular materials and systems.

The final outcome of this pathway is the mainstreaming of circular solutions. As collective demand stabilizes and market actors respond with tailored, scalable offerings, circular solutions become more affordable and accessible. This shift toward established, uniform practices results in lower costs, improved availability of circular options, and the embedding of CE criteria as a routine part of project development and procurement. The sector transitions from fragmented experimentation to an environment where circular practices are mainstream and repeatable.

Throughout this pathway, feedback mechanisms remain vital. As supply limitations or technical challenges arise, housing associations and market parties can iterate on requirements, further refining both demand and supply. Positive experiences, such as cost savings or simplified processes, reinforce the willingness to collaborate, creating a self-reinforcing dynamic toward continuous improvement and greater alignment on circular practices.

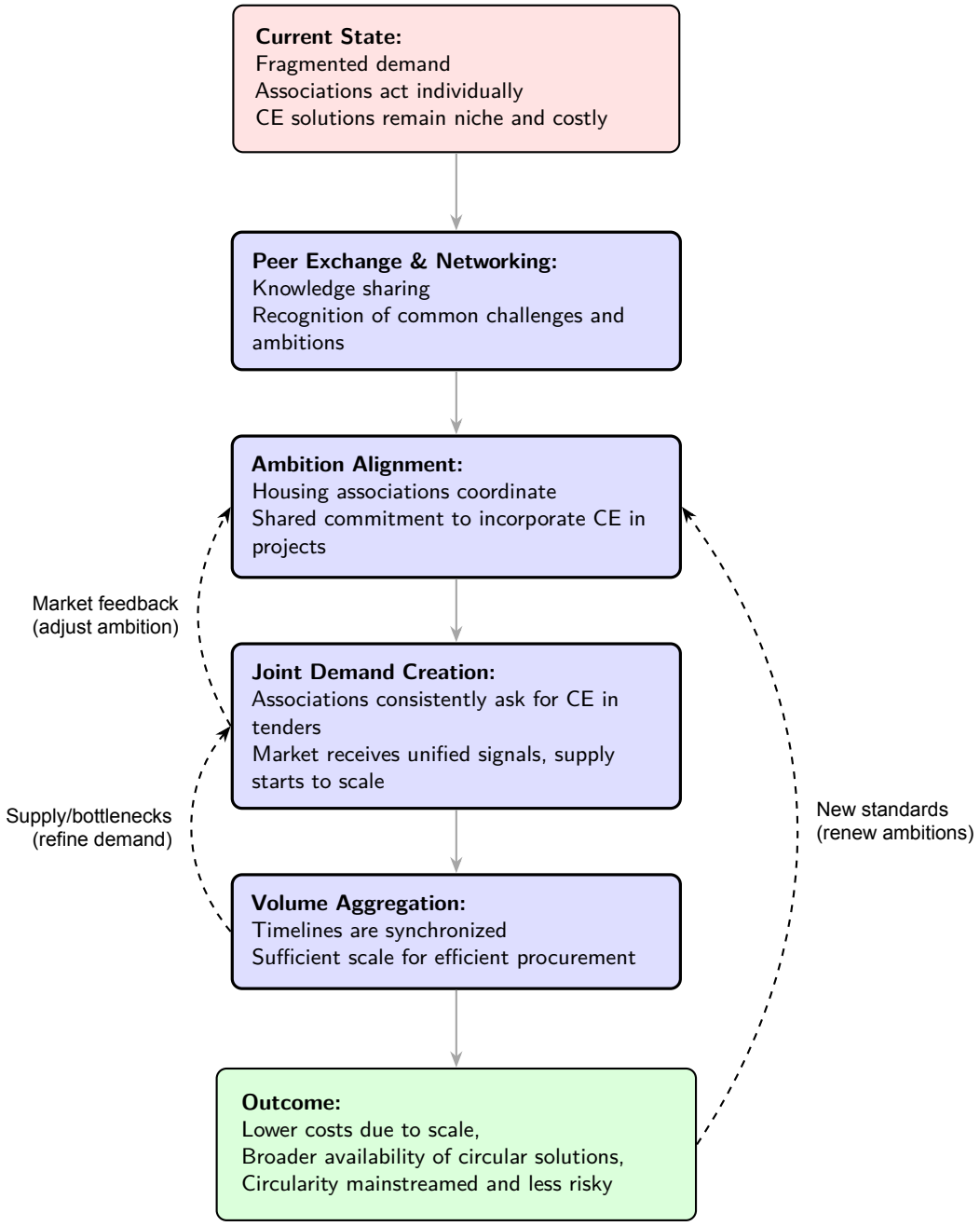

Figure 7.3: Pathway C

7.3. Expert Validation

To discuss the practical value of the framework, an interview was held with the program manager at *Aedes*. The aim was to learn which parts of the validation help day-to-day decisions. The expert confirmed the implementation gap: circular aims are widely supported, yet hard to embed under delivery pressure. She described the tension between throughput and circularity as real but often felt rather than measured: *"There is a tension in feeling … if you look at the measure level, the costs and benefits vary."* This shifts attention from opinions to decision points where evidence can be built.

A first valuable element was a shared term for the early filter in decisions: the *horizon gap*. Longer-term and component-level effects often sit outside standard appraisals and funding logic, so circular options drop out before selection. Naming this pattern gives a clear target for change in go/no-go and funding discussions. The expert also distinguished perceived from evidenced cost. Stories about "higher cost" spread easily; measured outcomes are rarer. This implies that internal knowledge and procurement practice (scope, phasing, comparators) are part of the solution, not only price.

The validation also clarified the order and linkages between efforts: knowledge before metrics, metrics before market (A $\rightarrow$ B $\rightarrow$ C). *Develop Circular Expertise* (A) enables teams to specify circular requirements, judge proposals on broader performance, and manage perceived risk; without such capability, new criteria can confuse. *Redesigning Business Model* (B) then adjusts appraisal and funding practice so circular value is counted when it matters, for example by making the appraisal window explicit and adding clear circular performance criteria alongside cost and time. *Build Market Supply* (C) aligns criteria and demand so suppliers face less uncertainty and can deliver reliably at volume. The value here is a sequence that reduces friction rather than adding it.

The interview made the pathways actionable by pointing to concrete steps. For (A): run short, hands-on pilots; hold brief after-action reviews; use simple checklists and templates; share lessons across projects. For (B): document effects from pilots and feed them back into business cases; make appraisal horizons explicit and extend where relevant; bring a small, stable set of circular criteria into go/no-go and selection. For (C): align criteria across clients; accept clear documentation for reused and biobased components; adapt warranty clauses to fit circular parts; use multi-year framework agreements to give predictable demand and lower supplier risk. Each step is modest on its own; together they form workable practice.

Finally, the expert set boundary conditions that keep recommendations credible. Outcomes depend on choices across the supply chain, not only on the client side. Housing associations work under a social mandate and budget limits; early external de-risking (e.g., guarantees or targeted subsidies) may be needed so initial costs are not shifted to low-income tenants. A stronger knowledge infrastructure is also needed so lessons are captured and reused, rather than remaining in isolated pilots. An asset-management lens helps too: looking at components and replacement cycles aligns circular value with core maintenance and performance goals.

8

Phase II Conclusion

Phase 1 showed two concurrent imperatives in Dutch social housing: volume (speed, cost, output) and circularity (long-term value, resource use). The system weights volume more strongly, creating a Capacity-Circularity Gap between ambition and what routine decisions deliver. To address this, three levers were identified under the control of housing associations: *Develop Circular Expertise*, *Redesigning Business Model*, and *Build Market Supply*.

Phase 2 examined how this gap arises in practice and how each lever can work. Semi-structured interviews were analyzed with a five-phase thematic procedure that linked literature-based codes to themes drawn from transcripts, keeping the analysis close to day-to-day decisions. The interviews specify where the gap is produced. First, filtering happens early: appraisal and funding logic do not capture longer-term or component-level benefits, so reuse, adaptability, and service-life effects do not enter selection at the right moment; the expert referred to this as the *horizon gap*. Second, circular knowledge is not widely embedded: know-how sits in a few pilots or motivated teams and is not yet part of standard routines, which keeps uncertainty high. Third, routine instruments pull choices back to the familiar: procurement and warranty practices, limited standardization, and turnkey offers make circular options feel uncertain even when feasible; under delivery pressure, teams choose what they perceive as ”no-regret” options. Expert validation reinforced these points and noted that part of the ”higher cost” issue is perceived rather than evidenced; changing decision criteria without sufficient understanding can create confusion.

Relative to the literature, the added value of Phase 2 is operational detail. The material pinpoints *where* the gap is made (early go/no-go and funding logic), *why* uncertainty persists (learning not embedded; standards unclear), and *which* adjustments make circular choices workable (capability, broader appraisal criteria, aligned demand). This introduces concrete decision points, shared terms used by practitioners (such as ”horizon gap”), and steps that fit the Dutch social-housing context.

Within this picture, *Develop Circular Expertise* focuses on building skills, tools, and repeatable routines so project teams can specify circular requirements, assess broader performance, and manage perceived risk; short, hands-on pilots with brief after-action reviews, peer learning across projects, and simple checklists and templates help translate experience into everyday practice. *Redesigning Business Model* concerns finance and appraisal: making the appraisal window explicit (and extending it where relevant), adding clear circular performance criteria alongside cost and time in go/no-go and selection, and feeding realized effects from pilots back into business cases so value is counted when it matters. *Build Market Supply* aligns demand and criteria across associations to improve availability and reliability without reducing pace; consistent circular criteria in tenders, accepted documentation for reused and biobased components, fit-for-purpose warranties, and multi-year framework agreements lower supplier risk and support delivery at scale. The expert emphasized that capability makes new criteria usable, improved criteria allow circular options to compete fairly, and aligned demand increases supply reliability.

Taken together, these moves address the points where the Capacity-Circularity Gap is made and offer

a practical route to narrow it: expertise where decisions are taken, appraisal and funding that recognize circular value, and a market that can deliver at volume.

III

Phase

9

Discussions

This chapter discusses how the thesis findings can translate into concrete sector initiatives that can implement the pathways in practice. It also steps back to reflect on the problem the research seeks to help solve. In doing so, the chapter clarifies what the limitations are of the research.

The chapter is organized as follows. Section 9.1 links the findings to current Dutch initiatives and explains how these can carry the pathways into day-to-day delivery. Section 9.2 reflects on the nature of the problem and the role of this research in addressing it. Section 9.3 sets out the main limitations of the study so readers can judge the scope of the claims and see priorities for future work.

9.1. Sector Initiatives

Across the Dutch housing field, several initiatives can support circular construction without lowering delivery volume. *Netwerk Conceptueel Bouwen* offers a national platform for industrialized and repeatable housing, with tools, templates, and a community where clients and suppliers work with shared formats (NCB, n.d.-b; VTW, n.d.). *De Woonstandaard* presents a set of product, market combinations. Each combination is a predefined housing concept that links a dwelling type and target group to a rent segment and baseline quality. In practice, each combination acts as a specification template: it sets ranges for size and layout, structural and facade principles, comfort and accessibility needs, energy and circularity requirements, and indicative delivery time and price bands. Because bidders respond to the same combination, tenders are easier to compare, and project teams can add an annex with local circular goals while keeping a common baseline (Aedes, n.d.-b; NCB, n.d.-a). *De Bouwstroom* groups projects so housing associations can purchase proven concepts together, creating predictable demand and learning through repetition; sector write-ups and program pages show how partners align criteria and timelines in practice (Aedes, n.d.-a, n.d.-c). Finally, *Conceptenboulevard* functions as a catalogue where standardized housing concepts are presented and compared, supporting faster and more transparent selection (Conceptenboulevard, n.d.).

These initiatives share a common logic: they create a shared language, reduce transaction costs, and send clearer signals to suppliers. This supports speed and cost control, which helps safeguard volume (NCB, n.d.-b; VTW, n.d.). They differ in role and scope. Netwerk Conceptueel Bouwen is primarily a knowledge and tooling platform (formats and peer exchange) (NCB, n.d.-b). De Woonstandaard is a content standard that structures demand through the product-market combinations and their baseline requirements (Aedes, n.d.-b; NCB, n.d.-a). De Bouwstroom is a procurement and delivery approach that aggregates projects into a multi-year pipeline (Aedes, n.d.-a, n.d.-c). Conceptenboulevard complements these by improving market transparency on available concepts (Conceptenboulevard, n.d.). Together they form a chain: learning and specification (Netwerk Conceptueel Bouwen), comparable baselines for selection (De Woonstandaard), coordinated market engagement at scale (De Bouwstroom), and a visible marketplace of solutions (Conceptenboulevard).

Sector initiatives now in place can help housing associations bring circular economy into everyday delivery without slowing down building. They can do this, as previously mentioned, by creating shared

formats, clearer information, and predictable pipelines. Shared formats lower transaction costs and make it easier to specify and compare offers; better information reduces uncertainty about quality, maintenance, and reuse; and predictable pipelines give suppliers the confidence to invest in circular products and services. Taken together, these elements turn circular ambitions into steps that fit normal planning, procurement, and asset management.

Within this broad support, each initiative links to a different part of the pathway framework. Netwerk Conceptueel Bouwen aligns with Pathway A (Developing Circular Expertise): its tools, templates, and peer learning help teams run short pilots, hold brief after-action reviews, and reuse simple checklists so lessons move from one project to the next. De Woonstandaard aligns with Pathway B (Redesigning Business Model): its product-market combinations provide a stable, like-for-like baseline for tenders, to which a short annex can add clear circular performance criteria at go/no-go and award, so longer-term value is counted when decisions are taken. De Bouwstroom advances Pathway C (Building Market Supply): by aligning criteria and timelines and aggregating projects into a multi-year pipeline, it lowers supplier risk, encourages investment, and scales what works across tranches. Conceptenboulevard complements these roles by improving market transparency across B and C, helping clients scan available concepts quickly and compare them against a common baseline. Used in the validated order, capability before criteria, criteria before market moves, the initiatives and pathways form a chain from learning and specification (A), to comparable selection and appraisal (B), to coordinated market engagement at scale (C), making circular choices reliable at pace and volume.

9.2. Reflection

During the research it became clear that the subject is a *many-headed monster*. The problem moves fast, affects daily lives, and extends far beyond just its engineering scope. It touches politics and policy cycles, public finance and guarantees, legal procedures and procurement, market capacity and standards, data and measurement, and also culture, values, and organizational habits. Choices in one area shape what is possible in another. This made the work both very urgent and very difficult.

This study aimed to provide a clear framing and practical entry points, but its evidence is necessarily partial. The approach was qualitative and time-bound, based on a small set of interviews and one expert validation, and situated in a changing policy context. Claims were tied to transcripts and to literature, and the pathways were formulated as testable steps rather than fixed solutions. The findings help to act now, but they do not close the debate.

9.3. Limitations

The reflection above shows the topic is a many-headed monster. In that light, the study has several limits that should guide how the results are read.

Limitations concern scope and sample, interpretation, context, time, and measurement. The empirical base is qualitative and small, built on semi-structured interviews with managers and policy actors in Dutch housing associations and one municipality; this purposive sample gives depth rather than breadth, and missing voices (contractors, major suppliers, architects, lenders, insurers, tenants, national policymakers) could shift emphasis.

Thematic analysis requires judgment, so despite systematic coding and iterative review, interpretation risk remains and another researcher might cluster themes differently or stress other mechanisms.

Findings are tied to the Dutch social-housing context, with specific laws, finance rules, and sector governance, so transferability to other countries or market segments should be cautious. The design is cross-sectional and policy, markets, and technologies change quickly, meaning some conclusions may date as rules or prices move; longitudinal follow-up is needed to see which steps persist and scale.

The study did not quantify full life-cycle costs and benefits, run life-cycle assessments or total cost of ownership on live projects, or test new metrics in controlled settings, so the pathways are actionable hypotheses to try and evaluate rather than proven causal effects. Finally, evidence rests mainly on interviews; project documents, procurement data, financial appraisals, and outcome metrics were not analyzed systematically, and stronger data triangulation would increase confidence.

Despite these limits, the study adds insight and offers concrete steps that practitioners can test or debate. Future work should widen the actor set, add quantitative and documentary data, and track projects over time to validate and refine the proposed pathways.

10

Conclusions

This chapter answers the main research question and fulfills the research objective. It presents the conclusions on how Dutch housing associations can balance speed and affordability with circular economy aims, explains how the three pathways work together to narrow the *want-can* gap, translates these insights into practical recommendations for key actors, and closes with a short agenda for future research.

The chapter is organized as follows. Section 10.1 presents the synthesis and states clearly what is new, what has value for practice, and how the Capacity-Circularity Gap looks in concrete decision moments. Section 10.2 sets out coordinated recommendations for the main actors in the field. Section 10.3 outlines a focused agenda for future work to strengthen the evidence base and support implementation at pace and scale.

10.1. Synthesis

This thesis concludes that the Capacity–Circularity Gap in Dutch social housing is the distance between what housing associations want on circular construction and what they can deliver within current rules and routines. Two imperatives sit side by side: deliver homes quickly and affordably, and build for long-term value with lower resource use. In daily work, throughput weighs heavier, so the “can” falls short of the “want”.

Evidence from practice shows three mechanisms that widen this distance. First, an early financial filter, the horizon gap, keeps longer-term and component-level effects outside selection and funding at the moment of choice, so circular options drop out before a track record can form. Second, circular know-how is not yet embedded in routine tools and workflows; lessons remain in pilots and uncertainty stays high. Third, procurement settings and the way risk and liability are handled pull decisions back to familiar solutions under delivery pressure, especially when evidence for reused and biobased parts is not standardized. If these points do not change, the “can” will continue to lag the “want”, even as ambition grows.

The research objective asked how associations can balance public values of speed and affordability with circular economy aims. The findings show that this balance is possible when decision routines change at a few key points. Developing Circular Expertise brings learning into everyday work so perceived risk falls without slowing delivery. Redesigning Business Model brings longer-term effects into selection and funding so circular options can compete on equal terms with familiar ones. Building Market Supply aligns criteria and demand across clients and fits contract risk allocation to reused and biobased components, which lowers uncertainty, costs and supports reliable delivery at volume. These pathways work in combination and are grounded in the comparative analysis of interviews and literature, strengthened by expert validation.

Taken together, these changes narrow the distance between “want” and “can”. They broaden what counts as performance in a way that fits current mandates and day-to-day processes. If they are

applied now, circular delivery can become routine at pace and scale. If they are delayed, today's rules will harden and the sector risks missing the national goal of a fully circular economy by 2050.

In a wider perspective, as mentioned in the introduction, crises are becoming more frequent and seem to be interconnected. Choices made in briefs, selections, and contracts set path dependencies for decades. Building with only a short-term lens can create lock-ins that weakens long-term resilience. Embedding long-term value in routine decisions can help society absorb future shocks. Small, consistent shifts compound into system change and keep strategic options open as conditions evolve.

10.2. Recommendations

Narrowing the distance between *want* and *can* requires coordinated action across the sector. The recommendations below set out what each actor can do now while keeping delivery pace and scale.

Housing associations, act from the stock (will) you own. Homes remain for decades, so near-term choices set long-term paths. Map the portfolio by intervention moments (renovations, replacements, planned new-build) and link circular aims to those moments. Prioritize components with high turnover and clear reuse or bio-based options. At portfolio level, publish a simple road-map that shows where circular measures will be tried, repeated, and scaled. In projects, use performance-based requirements and include a short circular section in selection documents so longer-term effects are counted alongside cost and time. Standardize what evidence is expected for reused and bio-based parts and fit contract risk allocation to those parts. Share lessons across projects on fixed intervals so knowledge moves from pilots into routine work. Where possible, align criteria and timelines with peers through existing initiatives such as De Woonstandaard, Netwerk Conceptueel Bouwen, and De Bouwstroom to send clearer signals to the market and reduce supplier uncertainty.

Public authorities and funders, need to share the first-mover load. Municipalities should include a short circular section and explicit time horizons in tender briefs, land tenders, and permit conditions, and coordinate pipelines with nearby associations (and private developers) so demand is predictable. National government and sector guarantors should recognize agreed circular criteria in funding decisions and allow longer time horizons where relevant. Early de-risking is needed; targeted guarantees, start-up subsidies, or revolving funds for first movers can prevent risk fear to try out circular options. Clear guidance on liability and proportionate documentation reduces friction at award and contracting.

Sector platforms. Keep the common toolkit current. Platforms such as Aedes and Netwerk Conceptueel Bouwen can help create concise criteria, accepted evidence formats, and model clauses for risk and liability. They should convene regular cross-project reviews and publish learned lessons so knowledge spreads beyond individual pilots. Maintaining and updating baselines and related templates (like De Woonstandaard) will help clients and suppliers compare like for like while leaving room for bio-based and reused-material variants.

10.3. Future Research

Future research should test and refine the pathways identified in this thesis, with a focus on where the distance between *want* and *can* is shaped in practice.

A first line of work could study sector initiatives and procurement collaborations in more depth. Studies on *De Bouwstroom*, *De Woonstandaard*, *Netwerk Conceptueel Bouwen*, and *Conceptenboulevard* can show how these platforms can give us insights on how they can help integrate the circular pathways without slowing delivery.

A second line of work could follow how circular aims enter early project development inside housing associations. Feasibility checks, requirement setting, and design briefing often decide what can be chosen later.

A third line of work should examine leadership and internal changemakers. Case studies in associations that have already or are trying to shift practice can show how leadership style, structure, incentives, and support mechanisms influence adoption.

Together, these studies can build a stronger evidence base on how to move from ambition to delivery. They can identify which design choices in collaborations, internal processes, and leadership most

effectively narrow the distance between *want* and *can* at pace and scale.

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