Circular construction in practice

Stakeholder roles and strategies for systemic transition in Danish construction projects

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Abstract:

This study examines how circular strategies can promote the construction sector's circular transition and collaboration between stakeholders across the value chains. It is based on two Danish case examples: Hostrups Have and Børnehuset Svanen.
Drawing on stakeholder theory and transition theory, the analysis explores how stakeholders influence the implementation of circular strategies—both internally within projects and in the broader systemic transition of the construction sector. The 9 R-strategies and circular flow strategies are used as analytical tools to understand how circular approaches are practiced in existing and ongoing projects, as revealed through qualitative interviews.
The analysis shows that there are many barriers to applying circular strategies in construction projects, even when the intention is present. One barrier is the complexity of power dynamics in the value chain.
At the same time, the findings highlight that a more circular approach requires integrating R-strategies already in the design phase, a prerequisite for a successful transition.
In addition to changes in regulatory frameworks, the circular transition also demands a willingness to step outside the comfort zone and rethink existing practices in design and execution.

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Preface

This is a 30 ECTS point project for the forth semester of the master's degree program Sustainable Cities at Aalborg University in Copenhagen. It was prepared from February 3, 2025, to May 28, 2025.

The thesis explores how the construction sector can be transformed by examining internal and holistic value chains. The aim is to contribute to understanding systemic change in the sector, with a particular focus on stakeholder dynamics and sustainability transitions.

We are deeply grateful to all the interviewees who generously shared their time, insights, and experiences. Their contributions have been invaluable to this research's empirical foundation and overall direction.

We would also like to express our sincere thanks to our supervisors, Stig Hirsbak and Arne Remmen, for their continuous support, constructive feedback, and encouragement throughout the process. Their guidance has been instrumental in shaping the project and motivating us to reach out to various stakeholders.

Reading guide

This thesis is structured according to academic standards and includes exploring the problem area, a clearly defined problem statement, a theoretical framework, methodology, analysis, discussion, and conclusion.

Chapter 1 presents the introduction. Chapter 2 then provides an overview of the environmental impacts associated with construction, followed by a brief description of current waste management practices and key barriers to implementing circular economy strategies in the sector. This leads to the problem definition in chapter 3, serving as the basis for the thesis's analysis. Chapters 4 and 5 present the theoretical framework and methodology underpinning the analysis and addressing the thesis's problem definition. The findings are examined in chapter 6 and discussed in chapter 8, ultimately culminating in the conclusion presented in chapter 9.

The thesis follows the Harvard reference style. All sources cited are listed in the reference section at the end of the document (see Section 9.1). References in the text appear as (Author, year). Cross-references are used throughout, with phrases such as 'See figure' and/or 'in section,' followed by the relevant section number. References to the appendix appear in the text as (Appendix 10). Figure references appear as Figure X.X in the text, where the first number refers to the chapter number and the second to the order in which they appear in the text.

Terminology

Construction sector
In the context of this project, the term construction sector refers broadly to all parts of the construction industry, including the development of buildings and infrastructure. However, when addressing the reuse of materials, the primary focus is on buildings.

Sustainable construction
The thesis uses the term sustainable construction to describe building practices that can reduce environmental impact through material reuse and circular planning. The focus is particularly on how strategies can reduce the use of virgin materials and waste.

Sustainable transition
The concept of sustainable transition is used as a systemic framework to analyze how the established construction sector can be gradually changed through new forms of collaboration, niche initiatives, and policy measures.

BR18
Bygningsreglementet (the Danish Building Regulations) is the national regulatory framework that sets technical requirements for construction in Denmark. It includes rules on energy efficiency, indoor climate, fire safety, and, starting in 2023, mandatory documentation of buildings' climate impact through life cycle assessments (LCA). (Social- og Boligstyrelsen, 2024).

CSRD The Corporate Sustainability Reporting Directive (CSRD) is an EU regulation that requires large companies to disclose detailed information on environmental, social, and governance (ESG) factors. In this thesis, CSRD is relevant as it shapes future requirements for construction sector actors to document the environmental impact of their activities, including circular practices and material use.

Names in Danish

Børnehuset Svanen
The first case example is Børnehuset Svanen, which translates to The Children's Institution the Swan. As it is the official name of a specific project, it will be referred to by its original Danish name throughout the thesis.

Hostrups Have
The second case example is Hostrups Have, which means Hostrup's Garden. Like the first, this name refers to a specific residential estate and will, therefore, also be used in its original Danish form in the thesis.

Forbrugerombudsmanden
The Consumer Ombudsman is an independent authority in Denmark responsible for ensuring that businesses comply with the Marketing Practices Act and other consumer protection laws (Forbrugerombudsmanden, 2025). The role is comparable to that of the Advertising Standards Authority in the UK. However, the authority is uniquely structured in the Danish context and is referred to by its name.

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Introduction

Today, the circular transition in the construction sector is a political necessity and a practical challenge. The construction sector accounts for a significant consumption of virgin materials and is responsible for large waste and $C0_2$ emissions. Based on international and national climate goals, the EU has, among other things, introduced the taxonomy and new emission requirements to promote a more sustainable and circular construction sector. Despite political ambitions, the transition is happening slowly, and the question is how the sector's practices and forms of collaboration can be developed in a more circular direction.

The thesis examines how circular strategies not only contribute to climate goals, but can also act as a driving force for new collaborations and roles in the construction value chain. The outset for the thesis are two construction projects, Børnehuset Svanen and Hostrups Have, which have each worked in their way to implement circular solutions in practice.

To understand how the circular transition in construction can be advanced, the focus must be on the structural frameworks and relationships that shape the sector's practices. The circular transition involves new technologies and materials and, to a large extent, rethinking established workflows the collaborations between stakeholders in the value chain. Therefore, systemic change requires a broader understanding of how dependencies and forms of collaboration is affecting the possibilities for implementing circular strategies in practice.

This provides an opportunity to investigate how circular strategies can contribute to transforming construction practices and forms of collaboration.

Problem analysis

The purpose of this chapter is to acquire knowledge about the extent of circular construction practices, their environmental impact, and how this affects the sustainable transition. Additionally, the chapter aims to identify the most significant challenges to achieving a more circular construction sector, examine the role of legislative frameworks in supporting or hindering this transition, and highlight how various initiatives are already seeking to address these challenges.

This knowledge is achieved by first addressing the environmental impacts of the construction sector and presenting developments in reusing materials and waste management. This is followed by the historical development of circularity in the sector, which leads to legislation focusing on the current laws for circular construction and on how possible future regulations may affect the sector. It then introduces the concept of the circular economy; building on this, existing strategies and initiatives to promote more circular material management are examined.

This overview is intended to provide a foundation for understanding the structural and practical dynamics within the construction sector that shape the transition toward increased recycling and reuse of materials. This problem analysis defines the scope of the problem area, forming the basis for the subsequent problem formulation.

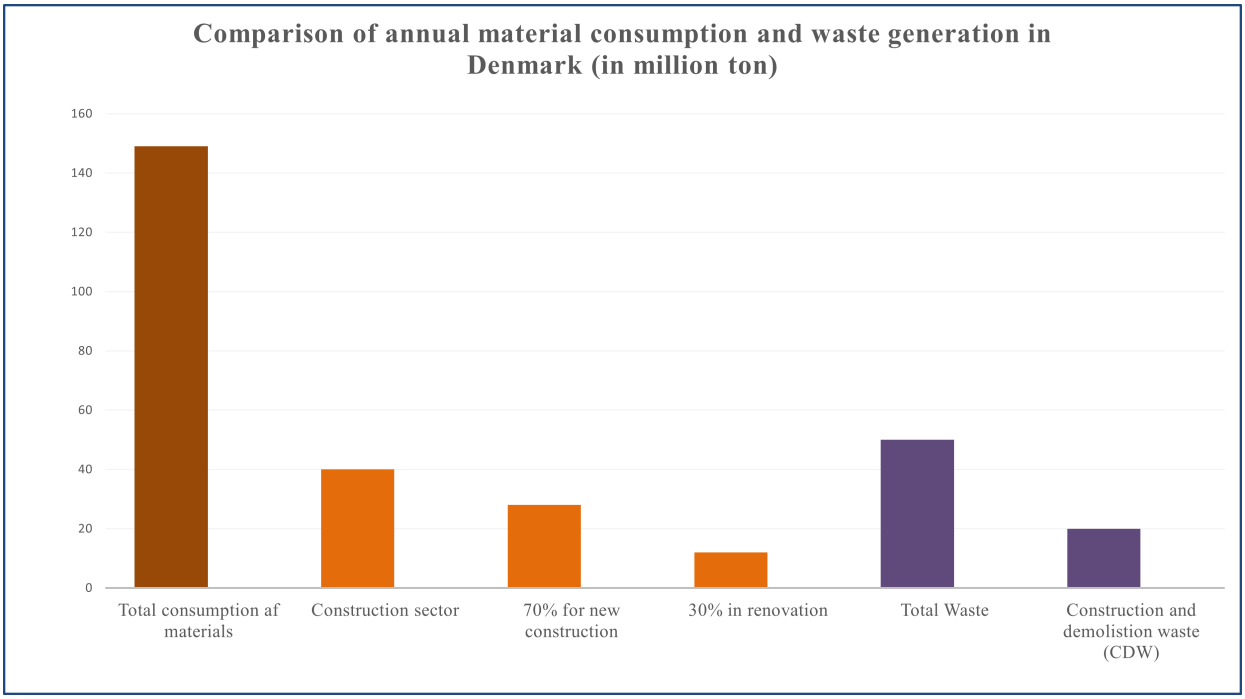
2.1 Environmental challenges and waste management in the construction sector

This section outlines the main environmental challenges caused by material consumption in the construction sector, with particular emphasis on consumption and CO_2-emissions. Furthermore, the section addresses waste management, given the sector's substantial role in generating waste.

The construction sector is one of the largest consumers of raw materials worldwide and is a considerable contributor to greenhouse gas emissions. High material demand not only accelerates resource depletion but also results in significant environmental degradation throughout the value chain in the construction sector, from extraction and processing to transportation and disposal. In 2022, Denmark consumed 149 million tons of materials, with the construction sector accounting for approximately 40 million tons of this consumption. This corresponds to a material footprint of 25.3 tons per capita, well above the EU average of 14.4 tons per capita (Danmarks Statistik, 2024).

Regarding waste generation, Denmark produced 50 million tons of waste in 2022, of which construction and demolition waste (CDW) accounted for 20 million tons, equivalent to 40% of the national total (Damgaard, 2022). Similarly, the construction sector was responsible for 300 million tons of Denmark's 800 million tons of CO_2 emissions, highlighting its considerable environmental

footprint (Danmarks Statistik, 2024; Damgaard, 2022). An overview of these figures is illustrated in figure 2.1.



Figur 2.1. Comparison for material consumption and waste generation for the total amount and in the construction sector, based on data collected fra (Miljø- og Ligestillingsministeriet, 2024; Damgaard, 2022; Danmarks Statistik, 2024)

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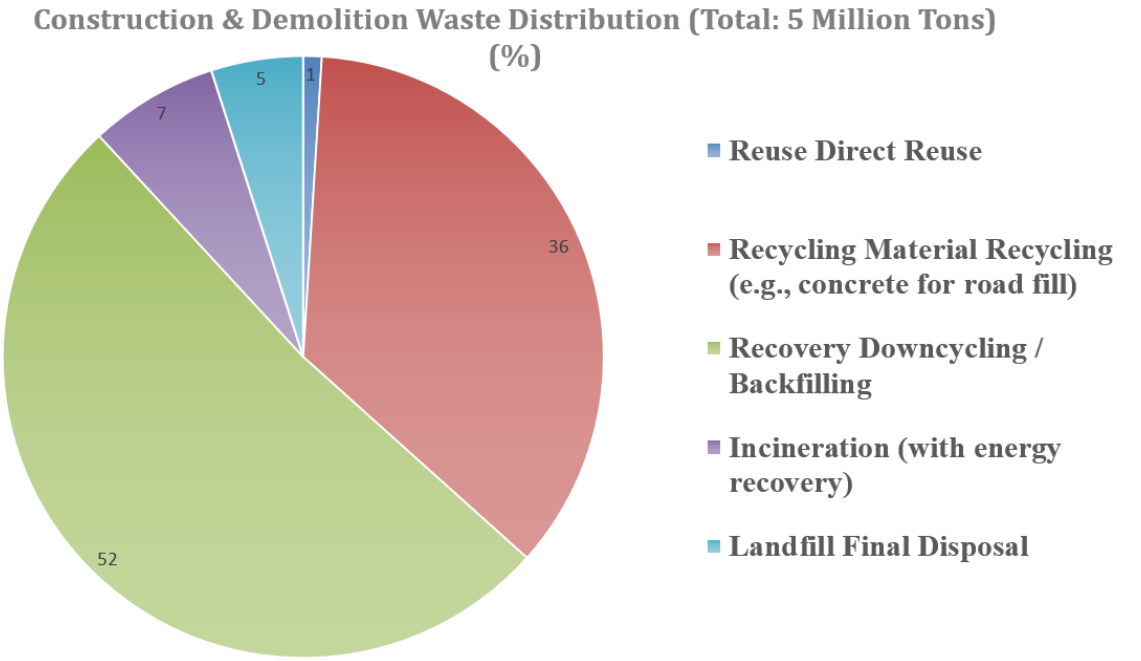
At the European level, CDW also constitutes nearly 40% of total waste (Damgaard, 2022). Although EU policy has led to a formal recycling rate of around 70%, most CDW is downcycled into low value applications as road base or backfill. It does not substitute high value virgin materials such as concrete, steel, or plastics (The Ellen MacArthur Foundation, 2024; Agency and Initiative, 2018). As a result, the actual environmental benefit is limited, especially when compared to higher level circular strategies such as refuse, reduce, reuse, and repair.

Recycling of CDW is thus an important part of the circular transition, but several structural challenges remain. National legislation requires that buildings undergo a thorough environmental screening before demolition to identify pollutants like PCBs and heavy metals (Miljø- og Ligestillingsministeriet, 2024). Based on this screening, materials must be mapped for proper sorting and possible recycling. While this supports safe handling and traceability, it also introduces administrative complexity that can discourage reuse, especially when there is no clear reuse project in advance.

From a circular economy (CE) perspective, despite its environmental intentions, waste regulation can paradoxically act as a barrier to systemic change. Current regulatory frameworks like the Danish Waste Management Order require hazardous waste mapping before demolition. This indirectly supports recycling but often reinforces lower-level circular strategies within the 9 R's framework (Miljø- og Ligestillingsministeriet, 2024), as elaborated in section 4.5.1. This tendency is reflected in the treatment of construction and demolition waste, where the majority is downcycled or used for backfilling rather than retained at higher value levels, as illustrated in figure 2.2. Similarly, voluntary initiatives like the EU's Level(s) framework (European Commission, 2020)

and the DGNB Certification (DGNB Denmark, 2024) promote higher level strategies, but adoption remains limited across the sector.



Figur 2.2. Distribution of Construction and Demolition Waste (CDW) treatment in Denmark, illustrating the dominance of downcycling and low value recovery strategies. Source: (Damgaard, 2022).

Moreover, several stakeholders in the construction sector experience a widespread lack of trust in the quality and traceability of reused building materials. This was documented, for example, in Circle Economy's analysis of the Dutch construction sector, where builders often opt out of reused materials due to uncertainty about technical properties and certifications (Circle Economy, 2023). Similar obstacles have been identified in an EU survey among small and medium-sized contractors in Eastern and Southern Europe. These point to a lack of incentives and unclear standards as reasons for low implementation (European Commission, 2021).

The classification of materials as "waste"further complicates circular practices. Once materials are officially designated as waste, reclassifying them is resource-intensive and costly and discouraging stakeholders from investing in reuse or advanced recycling (Concito and Build, 2023). This is exacerbated by the need to plan for reuse in advance, often before any clear construction project exists to absorb the recovered materials. The lack of temporary storage facilities also poses a challenge, as storing materials requires space and funding, which many stakeholders lack.

This creates a 'time mismatch,' where potential secondary materials cannot be matched to demand and are instead discarded (Concito and Build, 2023). Furthermore, varying interpretations of waste fractions across municipalities and receiving facilities create legal uncertainty, further complicating efforts to scale up circular practices (Concito and Build, 2023).

Overcoming these barriers requires more than technical improvements. It requires a fundamental shift in how materials are designed, handled, and circulated in the construction sector. Only then can policy move from enabling low level recovery strategies to facilitating true circularity, where material lifespans are extended, primary material demand is reduced, and design for disassembly becomes the norm (Circle Economy and European Commission, 2024; Circle Economy, 2023).

To provide an overview of the most relevant regulatory requirements, voluntary initiatives, and economic incentives influencing circular practices in the construction sector, Table 2.1 summarizes selected regulative frameworks at EU and national levels.

Category	**Responsible Level**	**Focus Area**	**Requirement/Target**
Legal Requirements			
Building Regulations (DK)	National	CO_2 Reduction	Max. 12 kg CO_2/m^2/year for new buildings (2023).
EU Taxonomy Regulation	EU	Sustainable Construction	Requires documentation of sustainability for construction investments.
Waste Management Order (DK)	National	Waste Handling	Requires mapping of hazardous waste before demolition.
Voluntary Initiatives			
Level(s) Framework	EU	Environmental Assessment	Voluntary framework for assessing building sustainability.
DGNB Certification (DK)	National	Circular Design	Voluntary certification focusing on resource efficiency and reuse.
Economic Incentives			
EU Taxonomy Regulation	EU	Sustainable Investments	Financial advantages for green investments in construction.
Green Investment Fund (DK)	National	Circular Construction	Loans for sustainable projects, including circular construction.

Tabel 2.1. Overview of selected requirements, initiatives, and incentives in the construction sector.

These frameworks illustrate how existing policies primarily promote recycling and safe waste handling (Miljø- og Ligestillingsministeriet, 2024; European Union, 2020), while voluntary schemes (European Commission, 2020; DGNB Denmark, 2024) and financial incentives (Vækstfonden, 2024) aim to push the sector towards greater circularity ambitions as reuse, circular design and reduced material consumption. However, as highlighted throughout this section, the practical implementation of these strategies still faces significant structural and economic challenges (Circle Economy, 2023; Concito and Build, 2023).

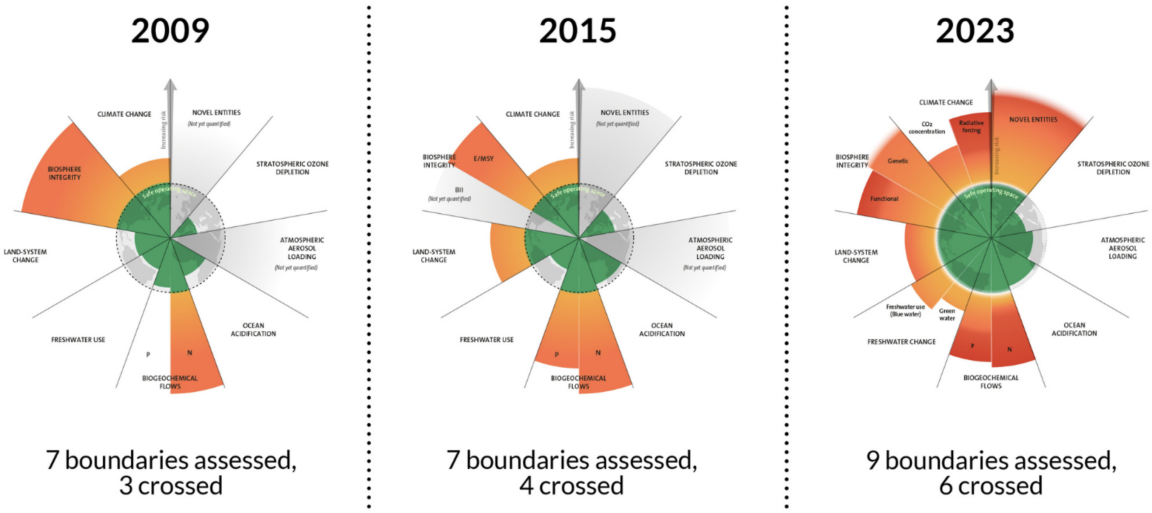
To better understand how the transition can be supported, the core principles of circularity and their application within the construction sector will be examined in the next section.

2.1.1 Historical development of circular principles in construction

The principles of CE in construction have developed gradually in response to increasing awareness of resource depletion and environmental degradation. While material reuse has been practiced historically, reusing stone and brick after wars, the formal adoption of CE gained traction in the 1990s and 2000s. The publication of *Cradle to Cradle* by McDonough and Braungart (2002) established a theoretical foundation, and the EU Circular Economy Action Plan of 2015 gave the policy direction to the member states (The Ellen MacArthur Foundation, 2015). Cradle-to-Cradle introduced a paradigm shift by proposing that products should be designed from the outset for continuous material cycles, eliminating the concept of waste. Instead of minimizing negative impacts, the principle focuses on creating positive environmental effects through regenerative design and using safe and healthy materials (McDonough and Braungart, 2002).

In Denmark, the circular economy began to shape the Danish agenda in the early 2010s. Before this, waste and resource management was primarily associated with environmental protection and pollution and, to a lesser extent, was related to consumption and material cycles (Concito and Build, 2023). A large part of society, especially the construction sector, was characterized by a decidedly use-and-throw-away culture, where the life cycle of materials was considered linear: extraction, production, use, and disposal. Repurposed and reused construction materials had low status and were often perceived as a sign of temporary or lower quality (CSR, 2023). The sector was built around producing and using new cheap materials rather than utilizing existing resources (Rockström et al., 2009).

This development has been challenged by increasing awareness of the planet's limitations. Two key concepts have helped to change the perception of resource consumption: **The planetary boundaries**, defined by Rockström et al. in 2009, set nine environmental limits that humanity should not exceed if humans want to maintain a stable and habitable planet, illustrated in figure 2.3. The limits include, among others, climate, biodiversity, nitrogen/phosphorus, and land use (Rockström et al., 2009).



Figur 2.3. The evolution of the planetary boundaries framework. (Credit: Azote for Stockholm Resilience Centre, Stockholm University. Based on Rockström et al. (2009), Steffen et al. (2015), and Richardson et al. (2023) Licensed: CC BY-NC-ND 3.0)

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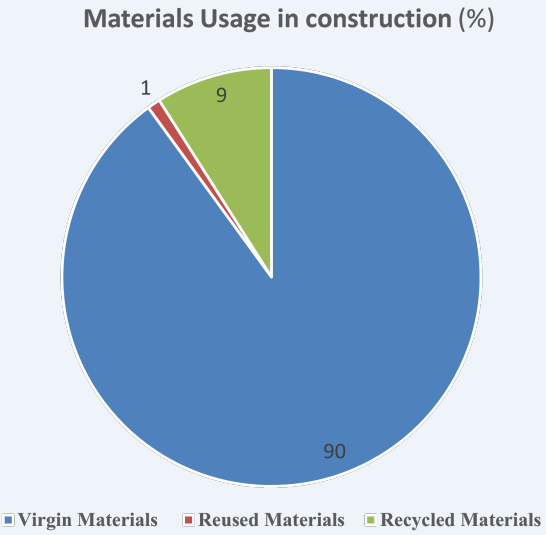
Earth Overshoot Day, introduced by the Global Footprint Network, marks the day on which humanity has exhausted the Earth's resources for the year in the respective year. In 2023, the day fell globally on August 2, while Denmark's national overshoot day was down in March (Network, 2023*b*). The concept illustrates how humans consume more resources than the Earth can regenerate.

Beyond these conceptual frameworks, the sector faces a tangible shortage of raw materials, especially in densely populated areas like Denmark, Zealand, and partly Funen. The availability of local resources like sand, gravel, and stone is diminishing rapidly due to decades of intensive extraction (De Nationale Geologiske Undersøgelser for Danmark og Grønland (GEUS), 2024). This shortage increases material costs and a growing dependency on long-distance imports, contributing to carbon emissions (Confederation of Danish Industry, 2022).

Virgin material consumption

On a national level, Denmark's consumption of virgin materials remains high, as stated in section 2.1. Within the construction sector, this dependence on virgin resources is particularly evident. As shown in figure 2.4, 90% of the materials used in construction are primary raw materials, while only 9% come from recycled sources and less than 1% from direct reuse without processing. These figures illustrate a strong linear material flow, where the use of existing resources is minimal despite growing environmental concerns and resource scarcity.



Figur 2.4. Material Composition in the Danish Construction Sector, based on data from (Economy, 2023), (Own production).

These realizations have increased pressure on the EU and national governments to promote circular principles. At the EU level, this led to the Circular Economy Action Plan launch in 2015 as part of the European Green Deal, identifying the construction sector as one of the key focus areas (The Ellen MacArthur Foundation, 2015). Complementing this, the EU Taxonomy Regulation introduced a classification system for sustainable economic activities, including construction, requiring companies and investors to document environmental performance and prioritize more resource-efficient solutions (European Union, 2020). This regulation is further elaborated in section 2.2.

In Denmark, the transition was concretized through the following initiatives:

- **"Denmark without waste" (2013 and 2015)**: The first national resource management plans, which introduced the concept of circular economy and focused on recycling and material reuse (Miljøministeriet, 2013).
- **Strategy for circular economy (2018)**: Designated construction as a key area of focus

and set up cooperation between public and private stakeholders (Regeringen, 2018).

- **LCA requirements in the building regulations (BR18)**: From 2023, new buildings over a 1000m^2 or more, must document their climate footprint through life cycle assessments, forcing developers and architects to think in more sustainable and circular solutions (Trafik, 2023).

These political and practical measures testify to the sector's gradual maturation and illustrate the growing recognition of the need for circularity and the challenges of translating theory into practice. Against this backdrop, legislation has become a central tool in shaping the transition, and it will be explored in more detail in the following section.

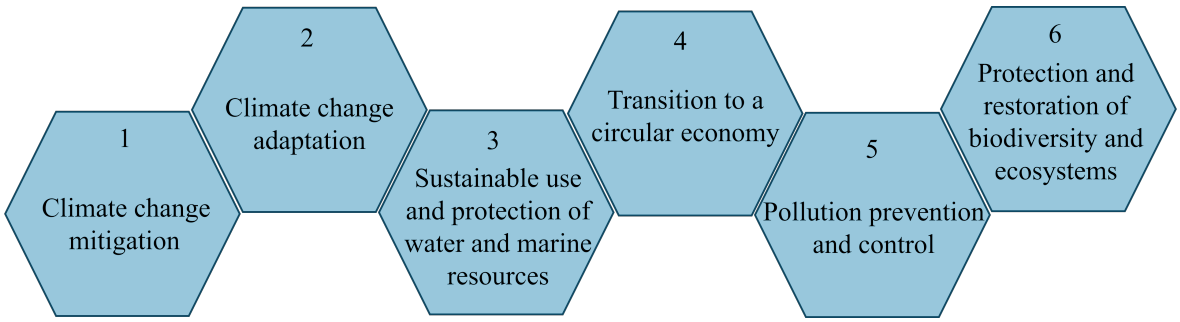
2.2 EU Taxonomy and the legal framework of sustainable construction

This section exterminates the key national and international legislative frameworks that shape the transition towards a circular construction sector in Denmark. The aim is to illuminate binding regulations and voluntary initiatives, reflecting how policy is increasingly used to drive sustainable and resource-efficient practices throughout the construction practices and value chain.

2.2.1 The EU Taxonomy

The EU Taxonomy of Sustainable Activities is a classification system that defines when an economic activity can be considered environmentally sustainable. In 2020, as part of the EU Green Deal, the taxonomy was intended to promote sustainable investments and strengthen capital and investments towards activities contributing to climate and environmental goals aligning with the transition to a circular construction (European Commission, 2025).

The taxonomy has established several specific construction requirements that must be met for an activity to be classified as environmentally sustainable. These requirements relate to the six overall climate and environmental objectives defined by the EU taxonomy illustrated in figure 2.5.



Figur 2.5. The six overall climate and environmental objectives defined by the EU taxonomy, based on a figure from (EU Taxonomy Navigator, n.d.)

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For a construction activity to be classified as sustainable, it must contribute significantly to at

least one of these objectives and meet specific technical screening criteria. Within the goal of transitioning to a circular economy, several requirements focus particularly on material selection, waste management, and design strategies. Table 2.2 provides an overview of the key criteria for new construction and renovation.

Tabel 2.2. EU Taxonomy and criteria for circular economy in construction, (European Commission, 2022).

Requirement	**Activity Type**	**Minimum Threshold**	**Notes**
Reuse/recycling of waste	New construction	90% of non-hazardous waste (by weight)	Applies during construction phase
Reuse/recycling of waste	Renovation	70% of non-hazardous waste (by weight)	
Retention of building structure	Renovation	50% of gross floor area must be preserved	To avoid unnecessary demolition
Life Cycle Assessment (LCA)	All buildings	GWP must be calculated for all life cycle stages	EN 15978 is recommended
Use of secondary raw materials	All construction	Minimize virgin material use	Use must be documented and justified
Design for disassembly	All construction	Strategy documentation required	E.g., material passport, modularity

Table 2.2 is based on the EU Taxonomy Delegated Act (Annex II, 2022), which outlines the technical screening criteria for activities contributing to the circular economy objective in the construction sector. It summarizes the minimum thresholds and documentation requirements that must be met for construction and renovation projects to be considered environmentally sustainable under the EU Taxonomy Regulation. (European Commission, 2022).

2.2.2 National and international regulations shaping the construction sector

As outlined in section 2.2.1, the circular economy in the Danish construction sector is regulated through various national and EU-based legislative frameworks that aim to promote resource efficiency, reduce construction waste, and minimize the environmental and climate footprint in construction.

A central element of Danish legislation is the Building Regulations (BR18), which sets requirements for, among other things, life cycle assessments (LCA) of buildings' climate footprint. In line with the increased political prioritization of sustainable construction, new climate requirements were introduced in 2023, requiring mandatory documentation of buildings' CO_2 footprints and compliance with emission limit values for new buildings over 1,000 m^2 (Social- og Boligstyrelsen, 2024). In addition, the handling of construction waste is regulated through the Waste Executive Order, which sets guidelines for waste sorting, recycling, and reuse to reduce resource consumption and waste volumes (Miljø- og Ligestillingsministeriet, 2024).

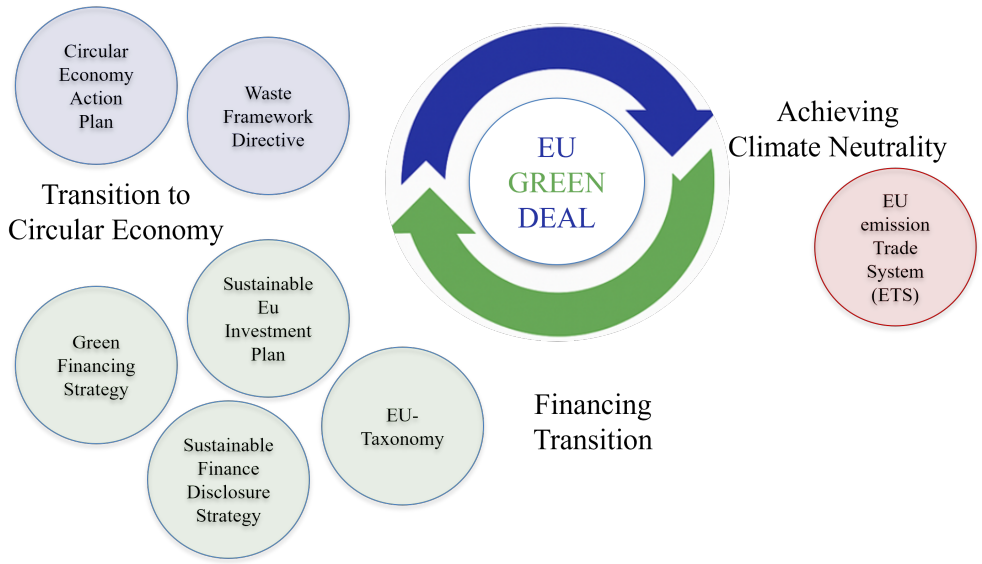
2.2.3 Current consequences and future changes by the European green deal and the Paris agreement

At the European level, The Green Deal has set the ambitions that Europe must be the first continent to become climate neutral to achieve this by 2050 (European Commission, 2019). This ambition is operationalized through the Circular Economy Action Plan (CEAP), which, among other things, will increase the use of reused materials and material traceability in the construction sector (European Commission, 2019). Upcoming legislation, such as the revised Construction Products Regulation and the Sustainable Products Initiative, will legally enforce these standards, compelling construction firms to rethink material choices, product life cycles, and waste management strategies (Dansk Erhverv, 2023). This regulatory shift will likely increase operational costs in the short term but drive innovation and long term resilience in the sector.

Dansk Erhverv (The Danish Chamber of Commerce) has developed an illustration of the current and future agenda for sustainable growth by providing an overview of the key elements of the EU Green Deal, Europe's ambitious strategy to become climate-neutral by 2050.

The figure highlights how the Green Deal spans various political initiatives and regulatory measures through several thematic areas. The EU Green Deal is at the center, while each large surrounding bubble represents a broad policy area. The smaller adjacent bubbles indicate each domain's specific directives, strategies, and tools. This visualization helps to map the complex policy landscape and its implications for different sectors.

Figure 2.6 focuses on selecting these instruments, grouped into three themes that are particularly relevant to the circular transition within the construction sector.



Figur 2.6. Existing and future EU-regulations with a focus on construction, based on Dansk Erhverv (2023) (own figure)

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At the center is the EU Green Deal, which outlines the overarching ambition of achieving a sustainable, climate-neutral, and resource-efficient economy. Surrounding it are interconnected policy clusters that support the vision from different perspectives:

- **Transition to circular economy:** This category includes legislative and strategic instruments that aim to reduce resource consumption, promote reuse, and improve waste management. The Circular Economy Action Plan and Waste Framework Directive provide a shared foundation for regulating material flows, while Green Public Procurement encourages circular practices in public construction projects (European Commission, 2019).
- **Financing the transition:** This group highlights the financial and regulatory mechanisms designed by the EU to channel private and public capital toward green and circular initiatives. Instruments such as the Green Financing Strategy, EU Taxonomy, and Sustainable Finance Disclosure Regulation help define and support sustainable investments. CSRD increases transparency and accountability for large companies, including those in the construction sector (Dansk Erhverv, 2023; European Union, 2020).
- **Achieving climate neutrality:** The Emission Trading System (ETS) represents a key climate policy, pricing emissions from energy-intensive industries as cement and steel production sectors closely linked to construction. Circular practices can reduce emissions by lowering the demand for primary materials (European Commission, 2019).

This classification clarifies how different parts of the EU Green Deal framework collectively support a systemic shift in the construction sector from a linear to a circular and climate-aligned model. In the context of the transition toward circular practices, as outlined in section 2.2.1, various regulations have been adopted by EU member states, including the CSRD. In April 2025, an omnibus act was introduced, directly addressing this issue and potentially influencing several existing legislative frameworks. A more in-depth explanation will be provided in the following section.

2.2.4 Stop the clock - Omnibus influence on the EU taxonomy

The Omnibus is an EU legislative initiative allowing simultaneous changes to multiple legal frameworks, including directives. These revisions can involve either amendments to existing legislation or complete rewrites, depending on the European Commission's assessment of what is most effective. The current Omnibus proposal primarily targets the CSRD and the EU Taxonomy Regulation, aiming to reduce administrative burdens for companies (Dansk Industri, n.d.).

One key aspect of the proposal is temporarily suspending CSRD reporting requirements for companies that have not yet started reporting. Listed companies already required to report in 2024 must continue to do so, regardless of whether they have fewer than 1,000 employees. It is estimated that approximately 80% of companies initially expected to fall under the CSRD will no longer be required to report under the updated directive, which is anticipated to take effect in January 2027 (Dansk Industri, n.d.).

A central component of the Omnibus is the proposed reform of the EU Taxonomy reporting obligations. These changes aim to make the taxonomy more targeted and proportionate to company size and capacity. The key proposed amendments are:

1. Mandatory Taxonomy reporting will be limited to companies subject to CSRD with a turnover exceeding €450 million (approximately DKK 3.35 billion).

2. Companies under the €450 million threshold may choose to report voluntarily under simplified taxonomy standards.
3. Reporting templates will be simplified to reduce complexity and increase usability.
4. A materiality threshold of 10%, based on revenue, CapEx, or total assets, is expected to be introduced to limit reporting to only the most relevant parts of a company's operations.
5. The complexity of the Do No Significant Harm (DNSH) assessment will be reduced, making it more feasible for companies to comply.

While the directive's final scope and wording are still under development, the proposed changes signal a significant shift in how sustainability and circular economy efforts, including those aligned with the EU Taxonomy, will be implemented and reported across the European business landscape.

2.2.5 CE marking and Forbrugerombudsmanden

Recent guidance from EU and national authorities allows reused products to be placed on the market without CE marking if they are no longer considered "construction products" under the CPR. In these cases, the materials must still comply with national requirements concerning safety, health, and environmental performance (UK Government, 2024). This regulatory ambiguity underscores the need for clearer pathways to integrate reuse into standardized construction processes.

In addition to requirements for CE marking, regulations also govern how construction projects can be marked when incorporating sustainability measures. Within the sustainable transition, the role of Forbrugerombudsmanden is central, as the authority enforces rules related to environmental marketing claims (Forbrugerombudsmanden, 2023). These claims are subject to strict regulatory scrutiny, particularly general environmental assertions. According to Forbrugerombudsmanden, claims can only be used if the product can be documented to have a significantly lower environmental impact than comparable alternatives (Forbrugerombudsmanden, 2023). This documentation must typically be based on a life cycle assessment (LCA) and ideally supported by an independent expert evaluation(Forbrugerombudsmanden, 2023).

Certain exceptions apply, such as when products are certified with official ecolabels like the Nordic Swan or the EU Ecolabel. In these cases, terms like "more environmentally friendly" may be used without a separate LCA, as the certification criteria are already based on LCA methodology. However, environmental claims remain prohibited if any stated benefit is substantially offset by other harmful environmental aspects of the product.

These guidelines highlight the importance of transparent and well-documented sustainability communication within the construction sector. To support this, organizations such as VCØB (Knowledge Center for Circular Economy in Construction) and Værdibyg (Build With Value) have developed practical guides and tools to assist developers, stakeholders, and designers in implementing circular strategies (for Cirkulær Økonomi i Byggeriet, 2023; Cirkulært, Vaerdibyg, 2023). Nevertheless, the practical transition towards circular construction still depends heavily on motivation, coordination, and stakeholder collaboration across the value chain (Concito and Build, 2023).

Legislation at national and international levels supports a shift towards more circular and more climate-friendly construction. Danish regulations like BR18, the Waste Executive Order, the EU

Green Deal, and CEAP introduce stricter requirements for documentation, material choices, and reuse. These frameworks drive the construction sector toward more sustainable and resource-efficient practices (The Ellen MacArthur Foundation, 2020).

2.2.6 Circular principles as a driver of climate mitigation

Circular economy principles are increasingly recognized as necessary to address the climate crisis. The Paris Agreement, which aims to limit global warming to well below 2°C and preferably to 1.5°C, calls for fundamental changes across sectors, including how materials are produced, used, and reused(Network, 2023*a*).

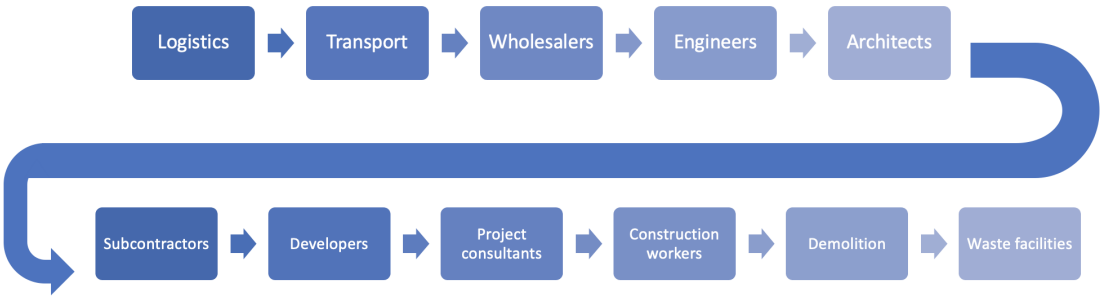
According to the Global Buildings Performance Network (GBPN), meeting the targets of the Paris Agreement will not be possible without substantial improvements in how buildings are designed, constructed, and demolished. Circular practices such as design for disassembly, material reuse, and minimization of virgin resource extraction directly support emission reductions in the sector (Network, 2023*a*).

The European Commission also highlights the importance of circularity in its Circular Economy Action Plan, which prioritizes the built environment as a key sector. It emphasizes lifecycle thinking, waste prevention, and increased use of secondary raw materials as central elements in achieving climate neutrality and resource efficiency by 2050 (The Ellen MacArthur Foundation, 2015).

By promoting material efficiency and extending the lifespan of buildings and components, circular strategies in construction can significantly reduce embodied carbon. This aligns closely with the objectives of the Paris Agreement, making the circular economy an important indirect pathway to climate mitigation. (Council of the European Union, n.d.). Still, turning these ambitions into practice depends on how the construction sector operates in reality, including the structure of the value chain and the roles of different stakeholders.

The current value chain in the construction sector

While circular strategies offer substantial climate benefits, their practical implementation depends heavily on how the construction sector is organized. To understand where and how circular principles can gain traction, it is vital to understand the current value chain and the collaborative dynamics that shape construction practices. Figure 2.7 illustrates how the construction sector typically operates in a linear flow, from resource extraction to waste, highlighting the fragmentation between key stakeholders.



Figur 2.7. Illustration of the linear building sector (own figure).

This structure inhibits integrated decision-making and hinders implementing circular practices across all project phases. Materials are often used only once before being discarded, leading to significant resource loss (Concito and Build, 2023). This reflects what the Ellen MacArthur Foundation (2013) describes as the “take-make-waste” model, in which raw materials are extracted, processed into products, used, and ultimately discarded after demolition. Such practices contribute significantly to environmental degradation and inefficient resource use.

At the same time, stakeholders such as subcontractors, developers, consultants, and waste handlers frequently work in silos, each prioritizing their deliverables. This undermines collaboration and results in missed opportunities for reuse and system-wide efficiency (Ellen MacArthur Foundation, 2013).

Therefore, achieving a circular transition in the construction sector requires new forms of collaboration and business models that support more sustainable and resource-efficient practices (Concito and Build, 2023). While the transition is already underway, there remains substantial potential for further action. Understanding these structural limitations helps identify where change is most needed. Based on this, the following section outlines the scope of the study. It introduces the analytical focus on promoting circularity through improved collaboration and restructured value chain relations.

2.3 Delimitation of the thesis

A holistic approach is applied to facilitate a comprehensive understanding. The analysis is primarily based on two case studies, Børnehuset Svanen and Hostrups Have, which had a strong circular agenda. In addition to these cases, insights are drawn interviews with experts across various knowledge institutions and related projects that have engaged with circular construction.

During the initial research phase, it became evident that many construction projects labeled as "sustainable"tend to focus on operational energy efficiency or the use of bio-based materials rather than on material reuse and recycling. Core circular economy principles, such as reuse, design for disassembly, and extending material life cycles, remain underrepresented in mainstream practice.

Although there are many guidelines and increasing legislative pressure to support circular construction, the transition has id too slow. This suggests that the primary barriers lie in access to knowledge and strategies and how stakeholders within the construction value chain collaborate

and organize themselves.

Based on this understanding, the thesis will focus on the role of value chain collaboration in enabling circular construction practices. The aim is to investigate how different stakeholders are affected by circular transition requirements and how their relationships facilitate or hinder the implementation of circular solutions in construction practice.

Research question

The transition towards a circular economy in construction is increasingly emphasized in policy frameworks and sector initiatives. However, the sector's practical implementation of circular strategies like reuse and repurposing of building materials remains limited.

To explore this gap between ambition and practice, the study draws on two construction projects that have actively engaged with circular approaches combined with semi-structured interviews with key stakeholders. These empirical insights form the basis for examining how R strategies are operationalized in practice and how they can foster new forms of collaboration, responsibility, and material flows across the construction value chain.

Rather than assuming a complete transition, the analysis focuses on how emerging circular practices and stakeholder dynamics can drive a broader systemic change, challenging established routines and supporting the ongoing shift toward circularity in the construction sector.

Research question

How does the transition toward circular construction practices affect the collaboration and stakeholder roles across the value chain, based on insights from the case examples Børnehuset Svanen and Hostrups Have?

To answer the research question, the following sub-questions are posed:

1. How do stakeholder roles shape the circular construction in the selected project examples?
2. How does stakeholder collaboration in construction projects influence the use of circular strategies and contribute to driving transitions toward more circular practices?
3. What is holding back the transition to a more circular construction practice, and what are the main barriers?

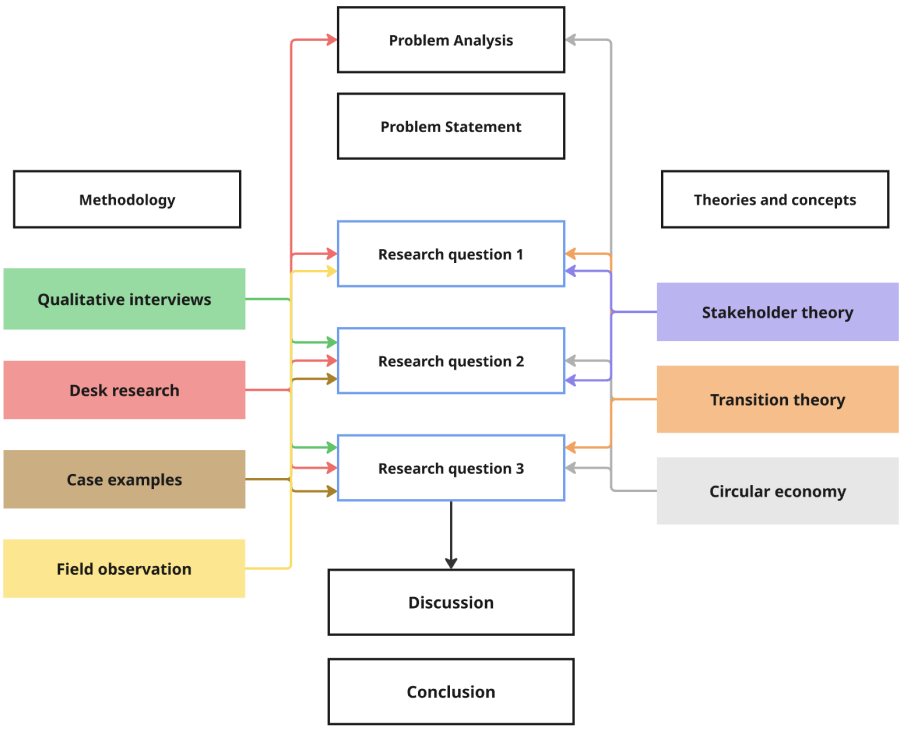
To address the problem formulation and its sub-questions, it is necessary to draw on theoretical perspectives that can help illuminate the roles of stakeholders, the mechanisms of systemic change, and the dynamics of collaboration in circular construction. The following chapter outlines the conceptual framework that guides the analysis, combining stakeholder theory, transition theory, and principles from the circular economy.

Conceptual framework

This chapter presents the theoretical framework that underpins the thesis' analysis and discussions. The framework combines theories that offer insight into the complex stakeholder landscapes and systemic changes required to promote circular practices within the construction sector.

Two main theoretical perspectives have been selected to comprehensively address the main research question and sub-questions: Stakeholder theory and transition theory. Stakeholder theory provides tools for identifying, analyzing, and prioritizing the various stakeholders involved in circular construction processes. In contrast, transition theory offers a broader systemic lens for understanding how changes in socio-technical regimes, such as the construction sector, can occur over time.

4.1 Research Design



Figur 4.1. A visualization of the research design, with arrows illustrating the connections between the sections, (own production).

The research design of the thesis is presented in figure 4.1. It overviews the theories, concepts, principles, and methods to address the main research question and the supporting sub-questions. These theoretical and methodological frameworks have been systematically used to guide the collection of data, the conduct of interviews, and the overall knowledge acquisition throughout the development of the thesis.

4.2 The implementation of circular economy in the construction sector illuminated through social constructivism and critical realism

This thesis applies a dual theory of science approach, combining critical realism, and social constructivism, to explore the implementation of circular principles in the construction sector. This combination reflects an understanding of the transition to circular practices, which is shaped by material structures and socially constructed interpretations(Berger and Luckmann, 1966). Critical realism allows for the identification and analysis of deeper structural and systemic conditions, such as legislation, market mechanisms, and resource flows, which shape the possibilities and constraints for stakeholders Stutchbury (2022). On the other hand, social constructivism enables an exploration of how stakeholders interpret, collaborate, and use circular strategies through their roles and collaborations across the value chain.

The study of circular strategies in the construction sector requires an approach that can account for conditions, such as legislation, procurement systems, technical requirements, and the complex interplay of social and organizational dynamics. Therefore, this thesis adopts a critical realist perspective as part of its theoretical foundation. As Stutchbury (2022) highlights, critical realism enables researchers to explore not only what happens in a project but also why it happens by uncovering the often invisible mechanisms that influence outcomes(Sismondo, 2010).

This perspective distinguishes between what can be observed (the empirical), what occurs (the actual), and the underlying forces that shape these outcomes (the real). This layered approach makes it possible to move beyond surface-level descriptions and identify the deeper institutional, economic, or technical structures that constrain or enable circular practices. In doing so, critical realism provides a valuable framework for explaining why circular solutions can remain difficult to implement in practice, even when intentions among stakeholders are aligned (Stutchbury, 2022).

The methodological framework, which combines interviews, field observations, and desk research, is a natural extension of this understanding. The role is not that of a neutral observer but part of an interpretive process that involves inquiring into and co-creating the understanding of how circular strategies work in practice. This also includes a hermeneutic recognition that understanding occurs through a movement between part and whole, between concrete experiences, and the overall structures that stakeholders act in (Gadamer, 1975).

Ontology
Critical realism assumes that reality exists independently of our knowledge and that this reality consists of underlying structures and mechanisms that shape observable phenomena (Stutchbury, 2022). In contrast, social constructivism views reality as shaped through social processes and linguistic constructions; what is perceived as “real” depends on how it is discussed and interpreted

(Sismondo, 2010). Combined, these perspectives enable an exploration of the material structures and the meaning of implementing circular economy practices.

Epistemology
Epistemologically, critical realism seeks explanatory knowledge about deep causal mechanisms while acknowledging that all knowledge is provisional and shaped by theoretical interpretation (Stutchbury, 2022). Social constructivism sees knowledge as socially produced and context-dependent, there is no single objective truth, but rather multiple valid perspectives Sismondo (2010). Together, these approaches make it possible to understand how the circular economy is practiced, framed, and legitimized within the construction sector.

In the example Hostrups Have, it is evident in the institutional frameworks and requirements that limit the use of reused materials or documentation requirements in construction cases. These frameworks exist as real conditions, but their significance only becomes clear through the stakeholder's experiences and practice (Sismondo, 2010).

This is supplemented by a constructivist social theory of knowledge, which emphasizes that knowledge is created in social processes and does not exist simply as objective facts (Berger and Luckmann, 1966). The interest in analyzing project examples and interviews is in how different stakeholders, developers, consultants, and municipalities understand and interpret circular principles differently. For some, it is primarily about waste sorting, while others associate it with design, long term durability, or value creation in material flows, (Berger and Luckmann, 1966).

Theory selection in light of the scientific foundation

Based on this combined ontological and epistemological foundation, the thesis frames the empirical analysis using stakeholder theory and transition theory.

Stakeholder theory enables the analysis of different stakeholders' interests and categorization in relation to the circular economy. From a social constructivist perspective, the theory allows for an understanding of how stakeholders' interests are shaped and legitimized within a given context and how different viewpoints compete to become the most accepted, (Berger and Luckmann, 1966).

At the same time, critical realism is used for identifying the structures, such as market mechanisms, regulation, or technological development, that create opportunities and barriers for various stakeholders, (Bhaskar, 1978). Transition theory, particularly the Multi-Level Perspective (MLP), reinforces this perspective. MLP operates on niche, regime, and landscape levels, thereby illustrating how societal changes result from stakeholder driven processes and structural shifts.

This combination of critical realism and constructivism provides the thesis with a solid foundation for analyzing how structural conditions and stakeholders' practices and understandings interact in implementing circular principles in construction. It also supports stakeholder and transition theories, which deal with relationships, roles, and changes in complex systems. (Sismondo, 2010). Together, these theories make it possible to understand the circular economy as a discursive construction shaped by stakeholders' perceptions and narratives and as a material practice rooted in real-world constraints and actions. This dual perspective corresponds with the thesis epistemological stance, which acknowledges social meaning making and structural causality (Freeman, 1984).

4.3 Stakeholder theory

Stakeholder theory provides a framework for understanding how organizations and projects are influenced by various actors who have different interests, positions, and levels of influence. Originally introduced by Freeman (1984), the theory challenges the narrow focus on shareholders and economic stakeholders by emphasizing that organizations must consider all actors who can or are affected by their actions.

In this thesis, stakeholder theory is relevant because circular construction projects typically involve a wide range of actors across the value chain, including municipalities, developers, consultants, contractors, and material producers. These stakeholders are connected through complex relationships and mutual dependencies that shape both opportunities and barriers for implementing circular strategies.

A broader understanding of stakeholder relationships, as introduced by Freeman (1984), forms a conceptual basis for the analysis. His emphasis on dialogue, interdependence, and mutual influence is used throughout the thesis to explore how trust, shared responsibility, and collaboration evolve in circular construction processes. These aspects are particularly relevant when analyzing how stakeholder interaction supports or hinders the transition from linear to circular practices.

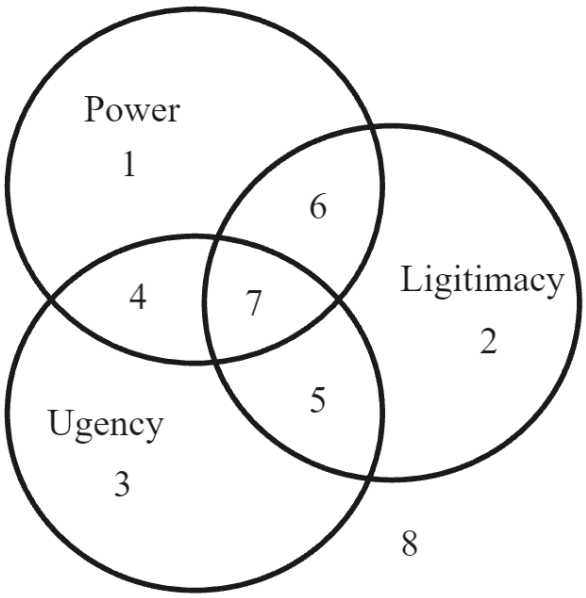
To perform a systematic stakeholder analysis in circular construction, this thesis applies the Stakeholder Salience Model by Ronald K. Mitchell and Wood (1997). The model provides a structured foundation for analyzing how different stakeholders vary in their influence and position across the value chain.

4.3.1 The Stakeholder Salience Model

In order to prioritize stakeholders, Ronald K. Mitchell and Wood (1997) developed a model in which stakeholders are classified based on three types of stakeholders:

1. **Power:** The stakeholder's ability to influence decisions or actions in the project.
2. **Legitimacy:** Whether the stakeholder's demands are perceived as justified or appropriate.
3. **Urgency:** How urgent or time-sensitive the stakeholder's requirements are.

The Stakeholder Salience Model provides a visual overview of how different stakeholder types are positioned based on the presence of one, two or all three attributes and is illustrated in figure 4.2



Figur 4.2. The Stakeholder Salience Model (Ronald K. Mitchell and Wood, 1997)

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A non-stakeholder (Area 8)
The salience model includes non-stakeholders to mark the boundary between relevant and irrelevant stakeholders. While non-stakeholders possess neither power, legitimacy, nor urgency, they are important theoretically, as they help clarify who qualifies as a stakeholder. Furthermore, stakeholders can shift from non-stakeholders to stakeholders over time, for example, by gaining legitimacy.

Latent stakeholders (Area 1-3)
These stakeholders possess only one of the three characteristics and are referred to as latent because their role in the project is often invisible or passive.

The stakeholder salience model is used to understand and map the broader stakeholder landscape in circular construction. Here, a latent stakeholder could be a resident or a smaller interest group that has a legitimate interest in materials from a demolition being recycled locally. However, these stakeholders typically do not have decision-making power or pressing demands and are, therefore, rarely actively involved in the project process. Their presence in the analysis illustrates that stakeholders with low visibility can still be relevant, if the context changes.

Expectant stakeholders (Area 4-6)
Stakeholders who have two of three characteristics are described as expectant because they typically have expectations of being heard or involved.

An expectant stakeholder in circular construction could be a contractor or material producer who works with recycled materials and, therefore, has a legitimate interest and a certain degree of urgency regarding schedules or access to resources. Although these stakeholders do not always have formal decision-making power, they are often important partners and have expectations of being involved. The analysis uses the model to understand how stakeholders position themselves in the value chain and what considerations their position may require.

Definitive Stakeholders (Area 7)
When a stakeholder possesses all three characteristics: ***power, legitimacy and urgency*** – they are referred to as definitive stakeholders.

Finally, the stakeholder salience model identifies the stakeholders who possess all three characteristics and should be considered definitive stakeholders. In the context of circular construction, it is assessed that municipalities typically occupy this role. They have formal decision-making authority and a legitimate responsibility to promote sustainability and often work within time frames linked to, among other things, planning, budgets, or political plans. In the analysis, the model is a tool to understand why municipalities have a particularly central position in the circular value chain and how this shapes opportunities and barriers to transition.

Stakeholders who score high on all three parameters are considered "definite stakeholders, meaning they require special attention. Stakeholders who only meet one or two criteria are prioritized less. Using this model, it can be assessed which stakeholders in circular construction have the most influence on the decision-making process, which stakeholders should be prioritized in the analysis, and who may be challenging to engage (Ronald K. Mitchell and Wood, 1997).

By combining the three theoretical frameworks, stakeholder relations in circular construction can be analyzed on multiple levels. The three perspectives make mapping, analyzing, and prioritizing stakeholders possible. This creates a deeper understanding of the structures of stakeholder relations, the strategic benefits of engagement, and which stakeholders are most important for the transition.

4.4 Transition theory

Transition theory offers a theoretical-analytical perspective on how circular principles can contribute to increasing the volume of material recycling in the construction sector. The theory deals with transition processes in socio-technical systems. It sheds light on the complex relationships between stakeholders, technologies, regulations, and practices that define a system's function and development dynamics (Holm, 2014; Geels, 2002). Applied to the construction sector, transition theory can help identify structural barriers and transformative potentials across the value chain.

The construction sector can be understood as a socio-technical regime where established norms, practices, and institutional frameworks create a strong track dependency that supports linear production and consumption patterns. According to transition theory, regimes are characterized by a high degree of stability, which implies that systemic changes often occur incrementally and meet resistance from existing structures (Holm, 2014). Barriers to implementing circular principles include a lack of standardization of recyclable building materials, economic incentive structures that favor conventional solutions, and regulatory frameworks that do not support circularity across the value chain.

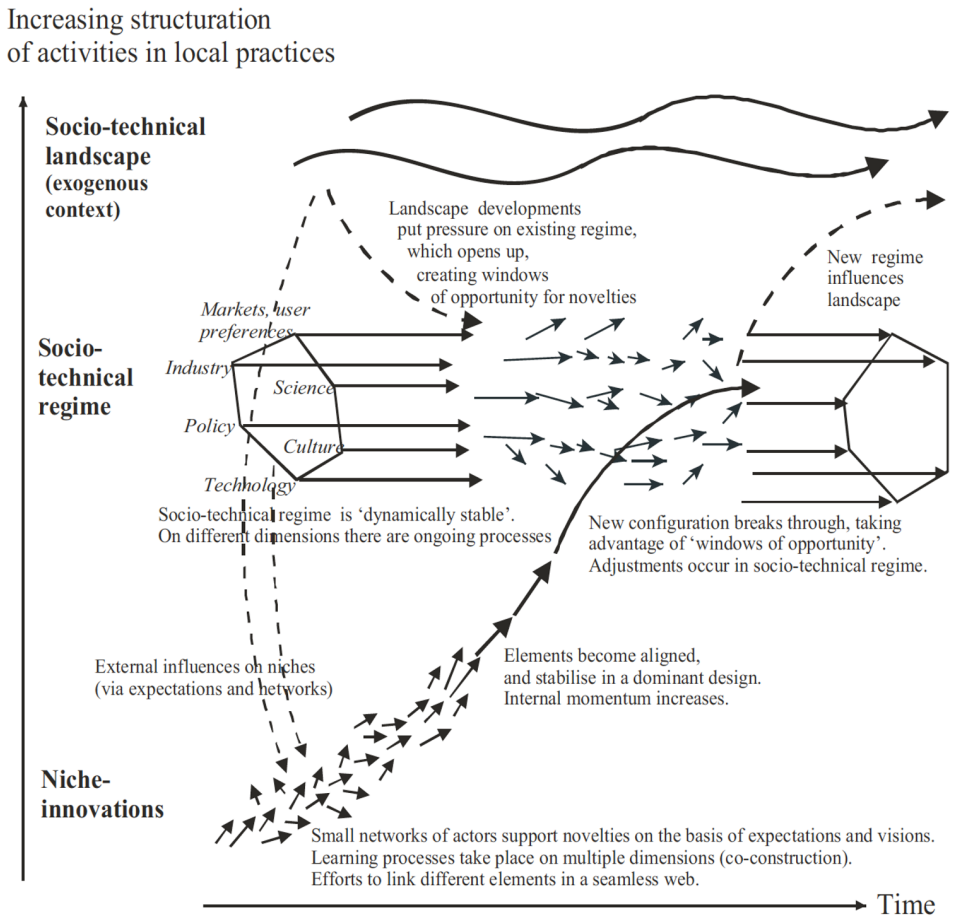
From a governance perspective, this transition poses a complex challenge, as political and institutional stakeholders must develop the capacity to support structural change and establish network-based governance structures that can facilitate collaboration across the different levels of the value chain (Holm, 2014). Understanding the dynamic interaction between regimes, niches,

and external system conditions is central to assessing how circular strategies can be strategically promoted in the construction sector.

4.4.1 The Multi-Level Perspective on sustainability transitions

Analyzing the dynamic relationships between regimes, niches, and landscapes is important to understand how circular principles can be promoted. MLP helps to analyze these dynamics and provides a foundation for assessing opportunities for structural change, (Geels, 2002).

The MLP is illustrated in figure 7.1, which outlines three levels, niche, regime, and landscape, forming a dynamic structure together. The regime is central, as transition processes are understood as shifts from one regime to another. Niches and landscapes are defined in relation to the regime as sources of innovation and broader system pressures. The link between MLP and the circular economy is described in the quote from Geels (2002): "The MLP views transitions as non-linear processes that result from the interplay of developments at three analytical levels: niches (the locus for radical innovations), socio-technical regimes (the locus of established practices and associated rules that stabilize existing systems), and an exogenous socio-technical landscape" (Rip and Kemp, 1998; Geels, 2002, 2005a).



Figur 4.3. Multi Level Perspective on transition, (Geels, 2011).

Transition is not a linear process; emerging new socio-technical regimes require either a "hole" in

the landscape or a niche innovation that meets an existing demand. As Geels (2011) also writes: "Niches are crucial for transitions because they provide the seeds for systemic change" (Geels, 2011). This highlights that niches enable the development of innovations that can later disrupt and transform established regimes, making them a fundamental starting point for broader transition processes.

In the construction sector, niches can manifest themselves in pilot projects, new forms of collaboration between stakeholders in the value chain, or political initiatives that promote alternative business models for material recycling. Over time, these niches can challenge the existing regime and catalyze a broader systemic transition towards a more circular economy.

4.5 Circular Economy

The circular economy encompasses an ambition to continuously reduce resource consumption. It should, therefore, be understood as an ongoing process and development towards increasingly resource-efficient solutions rather than as a fixed goal (Realdania, 2020). Therefore this part focuses on how the circular economy (CE) applies to construction, which represents a shift from the traditional linear value chain to a model focused on conserving resources in closed loops through principles such as reuse, recycling, and extending the life of building materials.

Despite the robust theoretical framework, the practical implementation of circular principles in construction remains limited. Studies by the Ellen MacArthur Foundation highlight that widespread adoption is still hindered by regulatory, financial, and logistical barriers (The Ellen MacArthur Foundation, 2024).

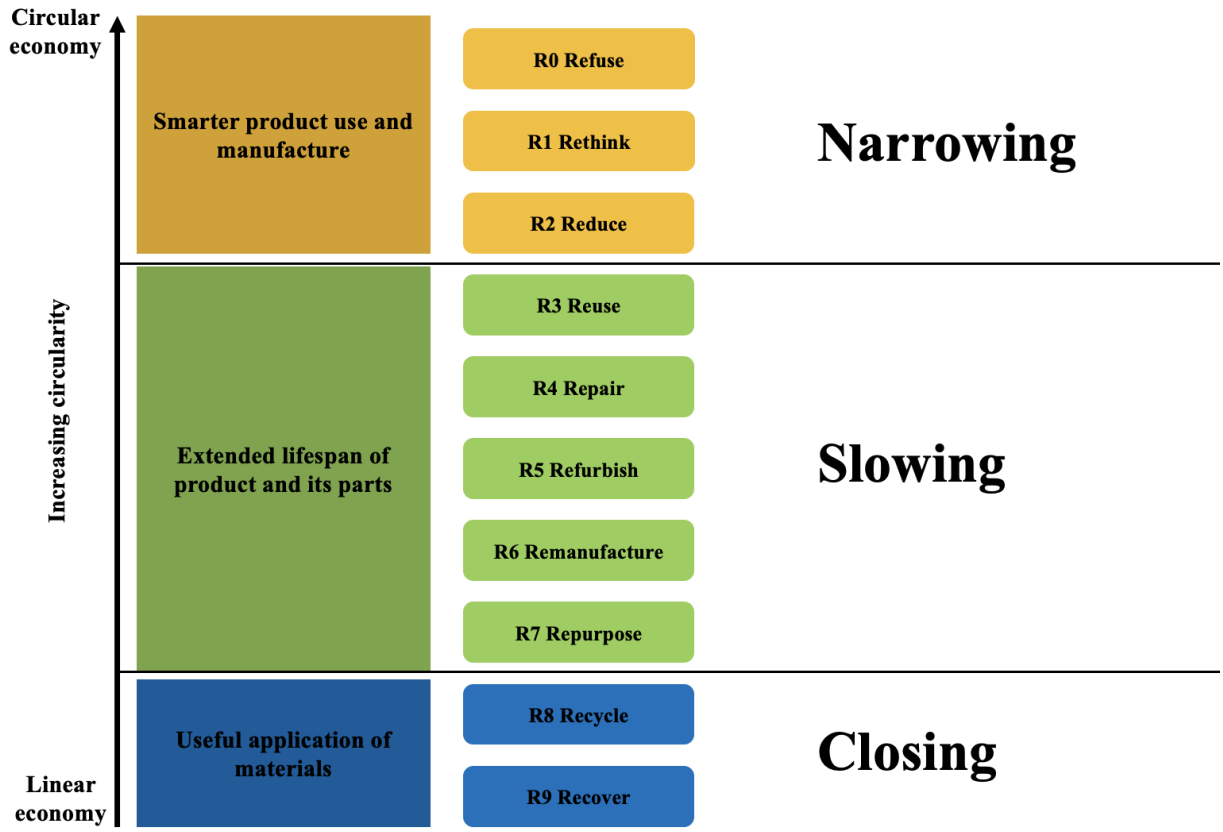
4.5.1 The 9 R's

Kirchherr et al. (2017) present the 9R hierarchy as a way to operationalize circular principles, which rank circular actions by their potential for reducing resource use. The top of the hierarchy, defined as high-level strategies, is Refuse (R0), Rethink (R1), and Reduce (R2), which represent high-value strategies that avoid or minimize material use altogether. Reuse (R3) through Repurpose (R7) focuses on extending the life of products and components, while Recycle (R8) and Recover (R9) represent lower-level strategies that deal with waste after use. The flow-based perspective helps contextualize the R-strategies by focusing on the resource impact being addressed. Each R-strategy can be mapped to one or more flow strategies:

- Narrowing aligns with R0–R2 and aims to reduce the need for virgin materials and energy input by making smarter design and production choices.
- Slowing corresponds to R3–R7 and focuses on extending the lifespan of products and components through reuse, repair, and refurbishment.
- Closing encompasses R8–R9, which involves recovering and recycling materials once they have reached end of life.

The conceptual framework outlined in figure 4.4 combines the 9 R's with the material flow strategies commonly referred to as narrowing, slowing, closing, and regenerating. These strategies are inspired by and adapted from the three core principles of the circular economy defined by the The Ellen

MacArthur Foundation (2024): **eliminate waste and pollution**, **circulate products and materials**, and **regenerate nature**. In this thesis, the principles are combined with the flow strategies and collectively referred to as *circular strategies*.



Figur 4.4. Flow- and R-strategies combined, based on (Kirchherr et al., 2017), (own figure)

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This allows for a more nuanced evaluation of each case example's circular potential and a clearer identification of gaps, missed opportunities, and structural barriers. The framework also provides a common reference point for comparing the two examples, which makes it possible to explore how stakeholder priorities and how the value chain dynamics affect the implementation of different circular strategies.(Ranta et al., 2020; Kirchherr et al., 2017).

In the construction sector, circular principles are applied at multiple levels. In the design phase, strategies such as Design for Disassembly support reuse and repurposing (R3–R7), while material selection focusing on bio-based or recyclable materials aligns with reduction (R2) and recycling (R8), (The Ellen MacArthur Foundation, 2024). Life Cycle Assessments (LCA) further contribute by identifying opportunities to reduce the environmental impact across the building's lifespan.

This combined framework of R-strategies and flow based principles will be used throughout the analysis to assess how circular actions are implemented in the two case examples. It enables a more nuanced evaluation of the degree of circularity and clarifies how such strategies are positioned within the broader value chain.

Methodology

This section will outline the methods used in the thesis and provide an overview of each approach and its role in supporting the analysis provided. This includes barriers, stakeholder collaborations, and transition strategies in circular construction. Each method is briefly introduced, followed by an explanation of how it is implemented to collect and process data. These methods ensure a structured basis for examining challenges and potential solutions connected to circular practices within the construction sector.

By combining qualitative interviews and desk research across two distinct project cases, the methodology provides a nuanced foundation for understanding how circular strategies are implemented in practice. Rather than a direct comparison, the cases explore different approaches, barriers, and stakeholder dynamics within the construction sector. This multi-method approach allows for triangulation of insights, strengthening the depth and validity of the analysis.

5.1 Qualitative Interviews

Qualitative interviews were selected as the primary empirical method to address the research question and explore the dynamics within the construction value chain. This enabled a detailed investigation of stakeholders' roles, motivations, and experiences that would be difficult to capture using quantitative or desk based methods alone (Brinkmann and Kvale, 2014).

Qualitative interviews were conducted with a range of stakeholders involved in the construction value chain to gain a deeper understanding of the barriers, existing collaborations across the value chain, and expert assessments of how the transition to circular construction can be achieved. Based on their professional roles and experience with sustainability and circular practices in the construction sector, these interviewees are viewed as experts in their respective fields. Their expertise not only lends credibility to the empirical material but also ensures that the insights gathered are grounded in current sector realities, thereby enriching the thesis's analytical depth and relevance.

The qualitative research interview is not merely a technical method but a craft in which knowledge is co-produced through dialogue between interviewer and interviewee. Rather than simply collecting facts, the qualitative interview aims to explore how individuals understand and give meaning to their world through language within the specific context of the interview (Brinkmann and Kvale, 2014). As interviewers, there was an awareness of the influence on the dialogue and the co-creation of meaning. Efforts were made to balance guiding the conversation and allowing participants to share unexpected insights. This reflexive approach contributed to a deeper understanding of each stakeholder's context and reasoning (Brinkmann and Kvale, 2014).

Prior to the interviews, participants were contacted via email, where they were introduced to the theme and purpose of the study, as well as how their experience and expertise could contribute to our analysis and findings. Semi-structured interviews were conducted via Microsoft Teams and structured, written responses were also collected. The interviewees represent various professional backgrounds and roles, including developers, consultants, municipal officials, sector organizations, and students.

Interviewees

Morten Ibsen **NIRAS**
Project Manager responsible for demolition and decommissioning.
NIRAS is a consultancy firm specializing in sustainable solutions across industries.

Rebekka Stender Ilsøe **LH Hockerup**
Sustainability Coordinator focusing on the practical implementation of sustainable solutions.
LH Hockerup is a construction company focused on integrating sustainability into building projects.

Janne Hagemann **Børnehuset Svanen**
Head of Børnehuset Svanen, Gladsaxe.
Børnehuset Svanen is a municipal daycare institution engaged in sustainable building operations.

Lone Lindgård Laursen **Ikano Home**
Head of Sustainability, responsible for the company's strategic sustainability efforts.
Ikano Home develops and manages affordable housing with a focus on sustainable living environments.

Martha Katrine Sørensen **Technological Institute**
Deputy Director for Sustainable Construction and Head of the Secretariat for EPD Denmark.
The Technological Institute offers expertise and consultancy within sustainable construction and environmental product declarations (EPDs).

Anke Oberender **Technological Institute**
Sustainability Consultant.
The Technological Institute provides consultancy services focused on implementing sustainability across industries.

Jan Larsen **Guldborgsund Municipality**
Head of the Building Department.
Guldborgsund Municipality works actively on integrating circular economy strategies into public construction projects.

Johan Elsass Nørby **Heimstaden**
Regional Manager focusing on sustainability in property management and new construction.
Heimstaden is a large property management company committed to sustainable housing solutions.

Representatives from Gladsaxe Municipality
Responsible for the municipal strategy and practices related to sustainable construction. Gladsaxe Municipality has come far in applying circular economy strategies in public construction projects.

Peter Hedegaard **Saint Gobain**
Director of Business Relations and Public Affairs.
Saint Gobain is a global leader in building materials, working towards sustainable material solutions.

In addition to the semi-structured interviews via Teams, two phone conversations were conducted with Johan Elsass Nørby, Regional Manager at Heimstaden, and a representative from Byens Tag og Facade. These short conversations will be referred to as phone conversations throughout the analysis.

By including various stakeholder groups, a broad insight has been gained into the challenges and opportunities related to sustainability in the construction sector. This underscores the reliability that refers to transparency and consistency in data collection and analysis, by applying a uniform set of questions in producer engagement and a systematic approach to evaluating environmental data. Validity, in turn, concerns the extent to which the thesis investigates what it intends to primarily gain the knowledge of to what extent companies apply and document sustainability in practice (Brinkmann and Kvale, 2014).

5.2 Desk research

As a foundational step in this study, desk research was conducted to gather and analyze existing knowledge related to circular building practices. Desk research, also known as secondary research, involves reviewing and synthesizing previously published material, such as academic literature, sector reports, policy documents, and case studies, to inform the direction and scope of the current investigation. This method has proven particularly valuable in mapping out the broader context of circular construction and identifying current challenges, best practices, and knowledge gaps within the field. Building on what is already known, the desk research ensured the subsequent qualitative interviews were targeted, relevant, and positioned within an informed context. (Travis, 2016).

5.3 Field observations

To better understand the case examples, the thesis employed field observations by conducting site visits to Hostrups Have and Børnehuset Svanen. Field observation is a qualitative method that allows researchers to study phenomena in their natural context and gather first-hand impressions that may not be captured through interviews or secondary data alone (Delamont, 2012). This was particularly valuable in assessing how circular strategies manifest in the built environment during the use phase.

The fieldwork included visual observations of the buildings' architecture, material use, spatial design, and indoor climate related functionalities. At both sites, the observations focused on how users interact with the space and how design choices support or challenge sustainable building operations. Photographs were taken to document key features and informal conversations were held with staff and users, especially at Børnehuset Svanen, to supplement the observations with user perspectives.

Field observations, combining visual documentation, descriptive notes, and informal dialogues, contributed to a situated understanding of the cases. This enriched the overall analysis by highlighting practical and contextual stakeholders who influence the implementation and daily functioning of circular building strategies.

5.4 Use of Artificial intelligence as a method

To enhance the clarity and coherence of the thesis, artificial intelligence (AI) tools were used to support the editing process. These tools were used to streamline the language, improve the structure of sentences and ensure a coherent academic tone throughout the thesis. It is important to ascertain that all analytical content, theoretical reflections, and empirical findings are the result of the empirical research and own work. The AI's main task is to support, improving the readability and flow of the thesis, while maintaining the original meaning and academic integrity of the content. This approach reflects an emerging academic practice, where digital tools are used not as a substitute for critical thinking, but as supplementary instruments in the writing process.

5.5 Reliability and Validity in the thesis

In qualitative and applied research, the concepts of reliability and validity must be adapted to the context and purpose of the study. Rather than focusing solely on statistical generalizability, qualitative projects emphasize transparency, consistency, and alignment between research questions, data, and conclusions (Malterud, 2011). In this thesis, different forms of validity have been addressed by combining methods and data sources.

The analysis is also informed by national guidelines from Forbrugerombudsmanden, particularly concerning green marketing and documentation requirements. These legal benchmarks provide an external reference point for evaluating whether environmental claims are justified. Such use of national regulation enhances the study's construct validity, ensuring that key concepts like "sustainability" or "eco-friendly" are assessed in accordance with established normative and regulatory frameworks (Yin, 2018).

Furthermore, the thesis assesses whether products marketed as environmentally friendly live up to such claims when scrutinized through life cycle data and relevant certification schemes (e.g., EU Ecolabel, Nordic Swan). By comparing green marketing claims with life cycle data and certifications, the study improves validity, as the findings reflect real-world conditions in which consumers and businesses interpret sustainability claims within regulatory and market-based contexts (Yin, 2018).

Lastly, the consistency in interview questions and the systematic approach to field observations contribute to the thesis' reliability, understood as the degree to which data collection and interpretation processes are transparent and replicable. This aligns with Malterud (2011) emphasis on trustworthiness and methodological coherence as key quality indicators in qualitative research (Malterud, 2011).

Analysis of key stakeholders in the circular transition through the salience model

Børnehuset Svanen and Hostrups have been examining how circular strategies are applied in practice. In the projects, sustainability was integrated from the outset. These cases are examples of how circular strategies can be implemented when specific prerequisites are met. A stakeholder analysis will identify the key stakeholders within the construction value chain who drive the circular transition.

The following section examines how selected circular strategies are applied in practice in the two cases. The analysis underscores the complexity of reusing materials in construction, the need for effective collaboration across the value chain, and the economic considerations that influence choices. It is to provide insight into how circular strategies can be integrated into the planning and implementation of renovation, demolition, and new construction projects.

The stakeholder analysis addresses the first research question: **How do stakeholder roles take shape in the circular construction in the selected project examples?**

By exploring R-strategies and the potentials inherent in the use of circular practices in the construction sector, the purpose of the further analysis is to answer the second research question: **How does stakeholder collaboration in construction projects influence the use of circular strategies and contribute to driving transitions toward more circular practices?**

This involves examining how established sector practices, power relations, and collaboration patterns influence systemic change toward circular construction. There is a particular focus to whether the applied strategies contribute to incremental adjustments within the existing framework or support more fundamental changes that challenge and reshape the prevailing linear structures.

6.1 Project examples

The following section presents two project examples that illustrate how circular strategies have been implemented in practice under different conditions.

6.1.1 Børnehuset Svanen

In 2018, Gladsaxe Municipality decided, as part of the Gladsaxe Strategy, to implement the UN Sustainable Development Goals in practice. (Gladsaxe Kommune, 2018*a*). Since then, the municipality has maintained a strong focus on green transition, with ambitions for CO_2 neutrality and sustainable construction, emphasizing circular solutions and Nordic Swan Ecolabel materials. According to Helen Glindvad Kristensen, this agenda laid the foundation for transforming Gl. Gladsaxe School into a new, Swan-labeled daycare institution (Gladsaxe Kommune, 2018*b*), in

line with the goals set out in the municipality's Green Transition Strategy. A picture of the new institution is shown in image 6.3. Here, the reused bricks and roof tiles as facades on some of the new buildings can be seen, and one can sense the shape of a swan, hence the name.

Image 6.1. Børnehuset Svanen (Dansk byggeri, 2023)

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Gl. Gladsaxe School phased out its last classes in 2012 and has been empty since, while the city council explored various scenarios for future use of the site (Gladsaxe Byarkiv, 2020). As part of the municipality's commitment to to implement and work with the SDGs, a new policy was introduced stating that all future daycare institutions should be Nordic Swan Ecolabeled. Tobaksvejen, where the old school was located, was identified as a suitable site for a new daycare center, and this led to the idea of reusing materials from the school to construct a new, sustainable children's facility (Cirkulært, Vaerdibyg, 2023).

As the former school and the future institution are municipally owned, Gladsaxe Municipality had the opportunity to set ambitious sustainability requirements for the project. This is due, among other things, to the fact that the Planning Act does not give municipalities the authority to set this type of sustainability requirements for private developers through local development plans. However, when acting as the developer, the municipality can define these requirements in its projects (Arkitektforeningen, 2024).

The original Gl. Gladsaxe School was inaugurated in 1921 and expanded several times, reaching its final form in 1937. During the 1960s and 70s, the buildings underwent multiple renovations. By the time demolition began in the summer of 2020, only one original wing from 1937 remained (Gladsaxe Byarkiv, 2020), (Byarkiv, n.d.). Because many of the materials in the oldest parts of the building dated back to a time before the widespread use of hazardous chemicals in construction, they were well suited for reuse (Genbrug, Vaerdibyg, 2021).

Image 6.2. Old Gladsaxe School, 1939 (Gladsaxe Byarkiv, 2020)

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6.1.2 Residential housing estate - Hostrups Have

Hostrups Have is a residential housing estate in Frederiksberg, built in 1935–36 and designed by architect Hans Dahlerup Berthelsen (Hovedstadshistorie, n.d.), (Heimstaden, 2018). The property comprises 680 homes and 30 commercial leases and was acquired by Heimstaden Danmark in 2017. In 2023, an extensive renovation was initiated, including replacing the roof and all windows throughout the complex (Heimstaden, 2023). As part of the renovation, a circular solution was implemented to recycle the discarded window glass into new glass wool – a concept known as "From glass to wool," developed by Saint-Gobain Isover (Heimstaden, 2024). The method had been tested in earlier projects and was introduced during the planning phase of Hostrups Have, enabling its integration into the project in collaboration with contractor Byens Tag & Facade and client Heimstaden.

Image 6.3. Hostrups Have in Copenhagen 2025 (Heimstaden, 2024)

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Hostrups Have is currently the largest example in Denmark of implementing the "From glass to wool" concept, demonstrating how material-specific circular strategies can be scaled up in large housing renovations (Heimstaden, 2024).

6.1.3 From project examples to stakeholder dynamics in circular construction

The two examples, the transformation of Gl. Gladsaxe School and the Swan-labeled daycare institution Børnehuset Svanen demonstrate different ways to implementing CE strategies in construction. While Børnehuset Svanen was planned with circularity as a strategic goal from the outset, Hostrups Have adopted a more selective method, incorporating a targeted CE solution within a broader traditional renovation.

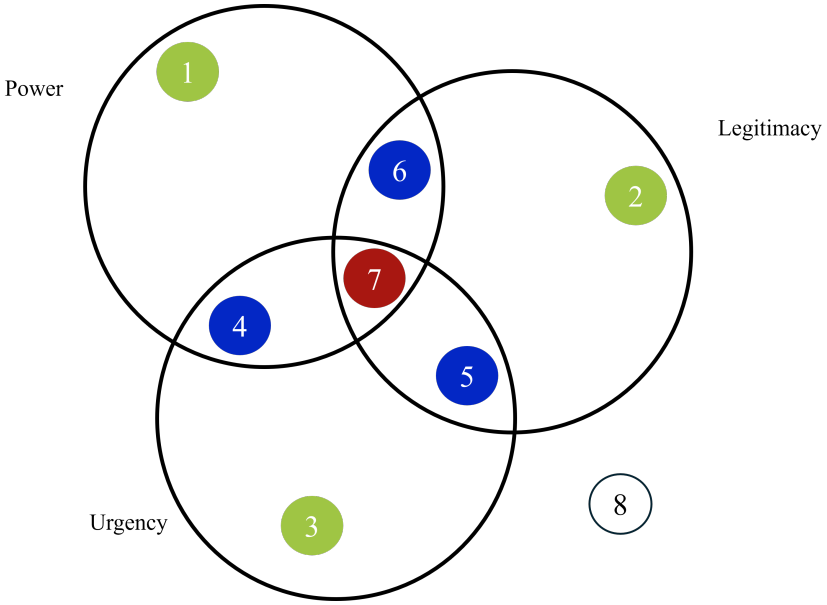
This underscores that circular construction is shaped not only by overarching project goals but by the collaboration and initiatives of specific stakeholders across the value chain. Rather than evaluating projects as entirely circular or not, it is often more relevant to examine where and how circular strategies take root, whether during planning, demolition, procurement or material reuse. These points reflect opportunities where stakeholders influence sustainability outcomes through their roles, interests, and interactions.

These observations informs the following stakeholder analysis, which explores the diversity of roles and relations in the construction value chain, and how these dynamics either enable or constrain circular practices in projects like Børnehuset Svanen and Hostrups Have.

6.2 Stakeholders in the circular value chain

The following section identifies the stakeholders involved in the transition towards a circular economy in the building sector, particularly how internal value chain relations either support or hinder circular innovation. Stakeholders are organized into three overarching categories, each comprising four distinct subgroups. This identification is based on a combination of desk research and semi-structured interviews with representatives from various segments of the construction value chain. These expert interviews provided nuanced insights into the diversity of stakeholder roles, particularly within the empirical contexts of Børnehuset Svanen and Hostrups Have.

As illustrated in Figure 6.1, ten primary stakeholders have been selected based on their knowledge of circular construction practices and active engagement within these specific case contexts. These stakeholders are subsequently categorized according to power, urgency, and legitimacy, following the Salience Model established in the theoretical framework 4.4.



Figur 6.1. The salience model, own production with inspiration from (Freeman, 1984)

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After the stakeholders have been identified and categorized, this section offers a deeper analysis by exploring each stakeholder's role and influence on the area in detail.

1-3 - Latent stakeholders

Rebekka Stender Ilsøe, LH Hockerup

Rebekka Stender Ilsøe, LH Hocerup, exemplifies the role of a latent stakeholder in the salience model. Although she holds legitimacy through her professional expertise, she lacks the necessary power and urgency to influence decision-making significantly. She points out that material shortages were already known a decade ago, yet not taken seriously "it was already clear ten years ago that there was a shortage of materials, but it was not really addressed at the time" (Appendix 10.2) illustrating how sustainability concerns were historically deprioritized. Only recently has sustainability begun to play a formal role in tendering processes "we have only truly had to account for sustainability and resource mapping in the last 1.5 years", signaling a slow shift in market practices. Ilsøe also welcomes the growing responsibility placed on developers, encouraging a stronger focus on material reuse: "Developers need to look more at materials than the design." However, she highlights internal barriers, noting that poor communication within her organization often prevents the sharing of important information. These organizational constraints and broader market dynamics limit Ilsøe's ability to act on her sustainability ambitions.

Morten Ibsen, structural engineer at Niras

Morten Ibsen from NIRAS can be characterized as a latent stakeholder for the project in charge of demolishing the old Gladsaxe School. Ibsen served as the project manager and thus held a legitimate role in the project's technical execution, particularly concerning the assessment of the chemical quality of materials: "qualified what is realistic, what is not realistic, and what we should say if we were to assess the chemical quality? It was acceptable. That is, concerning environmentally hazardous substances, and it is Swan-labeled". Although his expertise contributed significantly to the project's quality, he did not act as direct power over the final decision-making, and his claims were not characterized by a high degree of urgency. This positions him as a stakeholder possessing legitimacy but lacking the power and urgency necessary to assume a central role in the decision-making processes. Ibsen further emphasized that the project's favorable conditions for material storage and sufficient time are rarely present in comparable projects: "We had the space for it, we had the time for it. It often cannot be done in this way", further underlining the limited transferability of these experiences.

Finally, he pointed to the economic and collaborative challenges associated with sustainable projects, where success depends on a collective commitment to avoid conflicts over resources and task distribution:

> It probably requires that everyone wants it (...) because it is difficult to give a fixed price on such tasks, and you can easily end up spending more time than calculated, which affects the project economy, and sometimes people become dissatisfied and start shifting tasks between each other (Appendix 10.1).

The interview highlighted the success that can be in sustainable construction projects involving the reuse of materials, where all parties involved are given financial and time leeway.

Janne Hagemann - head of the Børnehuset Svanen in Gladsaxe

Janne Hagemann, head of the Børnehuset Svanen center in Gladsaxe, can be viewed as a latent stakeholder. She possesses legitimacy but lacks the power to directly influence decisions and the urgency associated with pressing claims. Despite her extensive knowledge and daily interaction with the building, Hagemann had no real influence during the design and construction phases. She mentioned that curtains are not allowed in a communal room used by children with special needs, as the architects believe it would disrupt the aesthetic expression of the space. The entrance area has also been designed as a orangery, but without heating or ventilation, it becomes cold in winter and uncomfortably warm in summer. Since many children with special needs cannot keep their hands off the plants, and there are also no resources to maintain them, it is impossible to have any greenery there (Appendix 10.3).

Image 6.4. The entrance greenhouse (Own photo).

Image 6.5. The training hall (Own photo).

Thus, she holds legitimacy as a daily user and person responsible for the institution's operations, she lacks the power to affect the building's design and was not considered a stakeholder with urgent demands during the planning process. Her role illustrates how a stakeholder with significant insight and legitimacy can be overlooked in decision-making processes, making her a clear example of a latent stakeholder (Appendix 10.3).

Common traits of the latent stakeholders

Common to the latent stakeholders is that none significantly influenced the case examples they either worked on or are currently involved in. They possess legitimacy through the knowledge and experience they can contribute from their professional backgrounds. They share a lack of power and urgency, which means they do not have a decisive voice capable of exerting pressure in decision-making processes.

4-6 - Expectant stakeholders

Lone Lindgård Laursen, Head of Sustainability, Ikano Homes - interview based on project "The Old Town Hall" in Høje Taastrup

Lone Lindgård Laursen from Ikano Homes is central to the company's sustainability efforts. Her position, however, is not entirely straightforward. In the salience model, she could be seen as an expectant stakeholder, combining organizational power and legitimacy to influence green initiatives. According to her, the management's strong commitment to sustainability gives her considerable autonomy: "They are quite engaged and ambitious on the sustainability agenda, which makes my job significantly easier because I have a mandate to initiate some things." Even so, she experiences significant barriers when turning strategic goals into concrete actions.

Ikano Homes is going to renovate the old town hall building for a specific project rather than tearing it down and building it anew. This sustainable decision, however, revealed how complex regulatory and economic stakeholders can hinder green ambitions. Because they opted for renovation, the project required a new local development plan, which "delayed the entire project by 1.5 years", with significant financial consequences. As Laursen explains: "I can just see that for us, it is extremely expensive and time-consuming. It is very advisor heavy to open this up." The circular agenda continues to struggle to become economically sustainable and, therefore, lacks market incentives: "It is not a good case economically(...). We need to make this project into a good case; otherwise, we will never get volume in the sector." This underscores that even with a mandate and strategy, sustainability remains a difficult battle when confronted with real economic and structural constraints.

Anke Oberender, Technological Institute

Anke Obrender, a sustainability consultant at the Danish Technological Institute, can be understood as an expectant stakeholder within the salience model, specifically, one with legitimacy and urgency though limited formal power. Her role focuses on enabling the construction sector's transition toward circular practices by building capacity and sharing knowledge between stakeholders. As she describes, one of her main contributions is that it is about telling the sector what is possible because others have succeeded with something, "so in that way, we can inspire and support the transition in the sector. using best practice dissemination as a tool to inspire and support broader transformation" (Appendix 10.7). As part of this work, the Technological Institute has also tested reused materials, such as bricks, to ensure their quality and suitability for new construction projects. This included material testing for Børnehuset Svanen, where the reused materials were actively incorporated into the final building, as seen in image 6.7.

This type of documentation is applied for building trust around circular solutions and reducing uncertainty among market stakeholders. This positions her as a facilitator of change, albeit one working from the margins of the regime. She reflects critically on the sector's slow progress, noting a sense of collective frustration: "There is a frustration because we have worked on this for so many years and have not come further. Or others say, it worked on this project, why did it not it work for us? Why is it so difficult?" (Appendix 10.7). These statements reveal a conflict between circular ambitions and systemic laziness.

Image 6.6. Testing the brick for the wall, (Teknologisk Institut, 2024).

Image 6.7. The indoor wall with reused bricks (Own photo).

Obrender points to structural and cultural challenges that hinder progress and the need for new competencies, new constellations of stakeholders, and new cost structures. “It suddenly becomes a much bigger mouthful (...)” (Appendix 10.7). Obrender remarks, illustrating how everyday operations clash with the complexity of circularity. Initiatives like those from the Capital Region of Denmark, where clients and advisors are brought together in circular ‘task forces’, show promise in building shared learning environments, but remain exceptions rather than the norm. Her comments further underline that without client eagerness, timeline flexibility and willingness to explore circular solutions, even well intentioned projects stall.

As regulatory requirements tighten, she expects biogenic and reused materials to become more mainstream not necessarily because of voluntary ambition, but because “As requirements tighten, it is expected that biogenic materials and hopefully reused materials will become more widespread, because it will simply be necessary to use them to meet the targets" (Appendix 10.7). This highlights the tension between regulatory push and organizational openness to change. It also underscores Obrender’s role as a stakeholder, an urgent voice for change, but one operating in a space where legitimacy often outweighs actual influence.

Martha Katrine Sørensen, Technological Institute

Martha Katrine Sørensen is from the same organization as Obrender and is involved in cases at the same level, she is an expectant stakeholder. This independent and commercial entity facilitates knowledge and advice on circular economy in construction. The Institute is respected, and her work with documented building materials and advisory services provides her with a credible position.

Sørensen has some power, though not in direct decision-making for large construction projects. Her influence lies in her ability to facilitate knowledge and guide companies in adopting circular economy strategies in construction. As an advisor, her indirect power allows her to influence decisions at smaller businesses or project levels, especially regarding recycled materials. While Sørensen's efforts to promote a circular economy are not immediately pressing, she works to raise awareness and garner political support, which could create future opportunities for faster implementation. (Appendix 10.5). Overall, Sørensen holds high legitimacy and moderate power as an advisor and facilitator in the circular transition of construction.

Jan Larsen, environmental caseworker in Guldborgsund Municipality
Jan Larsen from Guldborgsund Municipality's building permit department fits the role of an expectant stakeholder in the salience model. He holds legitimacy and some power but operates within limited urgency. His role is mainly administrative, ensuring compliance with building regulations, "while only a small share of cases undergo sample control "only 10% of commercial cases are selected for control" (Appendix 10.6). Although sustainability intentions exist, the economy remains the primary driver, "economy is still the biggest factor" (Appendix 10.6). Larsen also notes political disagreements in the city council, where debates arise between building green and maximizing square meters "there is sometimes disagreement about whether we should build green and sustainable or achieve the square meters" (Appendix 10.6), reflecting how political priorities shape the room for sustainable action. Although Larsen is not directly involved in the examples, he is a municipal stakeholder representative who provides valuable insights into the regulatory and political frameworks that influence sustainable construction.

Common traits of the expectant stakeholders

Across the different stakeholder perspectives, shared challenges and structural dynamics become apparent, especially in the struggle to turn sustainability ambitions into concrete action. This means that even stakeholders with strong professional or institutional positions experience limitations in their ability to translate sustainable visions into practice. A central common feature is the gap between ambition and structural barriers. Many stakeholders express an apparent willingness to promote a circular economy but face challenges in the form of economic incentives, heavy regulation, and cultural resistance within the construction sector. This creates a persistent mismatch between strategic intent and practical feasibility.

Another shared characteristic between Obrender and Sørensen is that their influence is often indirect. Working with knowledge sharing, consultancy, or administrative processes, they do not hold direct decision-making power but attempt to influence others through dissemination, facilitation, and dialogue. This places them in a position where they have high legitimacy but rely on the actions and priorities of others to bring about real change.
Finally, the analysis of the expectant stakeholders indicates that urgency within the sustainable transition is primarily driven by individual engagement or external regulatory pressure rather than being embedded as a systemic necessity.

7 - Definitive stakeholders

Johan Elsass Nørby Johan Elias Nørby is a Regional Manager at Heimstaden and holds a position of apparent influence in the circular construction landscape, categorizing him as a definitive stakeholder. Representing a client organization with the organizational power to shape project decisions and the legitimacy to define the direction of sustainable initiatives, his role became particularly evident in Heimstaden's partnership with Byens Tag & Facader.

In a large-scale project, Heimstaden facilitated the reuse of discarded window glass to produce new glass wool insulation. This case illustrates how a developer can act as a central enabler of innovation by being open to alternative solutions and ensuring that collaboration between stakeholders and material producers leads to practical outcomes. As Nørby explains, "the agreement was made in collaboration between the contractor on the project and Heimstaden" (Appendix 10.8). The scale of the project underlines the significance of decisions, as illustrated in image 6.8, which shows Hostrup's Have from the inner courtyard towards the facades with scaffolding and many windows prepared for material recovery.

Image 6.8. The inside og Hostrups Have, half way through the facade renovation, (own photo)

Rather than simply signing off on sustainable initiatives, this illustrates a stakeholder leading and actively enabling circular solutions through strategic collaboration.

Nørby points out that the most significant obstacles are not only technical but regulatory "The biggest barriers are A) the performance requirements for the quality of the reused materials, and B) the quality of the final product, including documentation that it meets authority requirements (building code and norms)" (Appendix 10.8). Nørby's recognition that "only a few large suppliers can deliver the documented quality needed" (Appendix 10.8), underscores how rooted supply structures inhibit broader implementation. Still, his involvement demonstrates that when developers like Heimstaden actively collaborate with stakeholders and material producers, niche solutions, like the window-to-wool circularity, can become viable within existing regime structures.

Gladsaxe Municipality As a project developer, Gladsaxe Municipality played a central role in enabling circular solutions. Aware of the project's innovative nature, they deliberately chose advisors with relevant experience and brought in Lendager Group early to ensure flexibility during the initial phases (Appendix 10.9).

The municipality took full advantage of the unique conditions of their site with a decommissioned school and adjacent sports fields, which allowed them to retain all demolition materials onsite. "We were in the unique situation that it was a closed down school with sports areas (a football field) nearby, which gave us the opportunity to keep the materials on site (...). "This meant we avoided unnecessary transport" (Appendix 10.9). The remaining materials and the designated storage areas can still be seen on-site, as illustrated in the photos in imaged 6.9, which document how the municipality utilized the available space for onsite material storage.

Image 6.9. Overview of the storage area. Left: Remaining materials on site. Right: Designated storage area during the project, (own photos)

Challenges did arise, particularly in reconciling reuse ambitions with official certification systems. As described in the section 6.1.1, Gladsaxe Municipality requires all new kindergartens to be Nordic Ecolabelled, which poses a significant obstacle. The strict criteria of the Ecolabel were initially difficult to align with the use of reused and repurposed materials. As the municipality explains: "This, combined with reuse and recycling, was a challenge for Miljømærkning Danmark; but we also met great willingness to find solutions (Appendix 10.9)". These negotiations highlight the tension between innovative sustainability practices and existing regulatory frameworks.

The municipality is an important definitive stakeholder because it possesses all three attributes of the salience model. As the public developer and initiator of the project, it held decision-making authority and financial control (power), acted within a framework of public responsibility and environmental goals (legitimacy), and faced pressing demands to align with climate policies and circularity goals (urgency).

Their ability to set ambitious requirements insist on keeping all materials onsite, reuse everything possible, and stipulate Nordic Swan Ecolabel certification demonstrates their strategic influence in shaping and implementing circular construction practices.

Peter Hedegaard, Director for business relations and public affairs in scoping, Saint Gobain – Hostrup have

Peter Hedegaard from Isover is positioned as a definitive stakeholder in the salience model due to its significant influence over material solutions, strong legitimacy as an established sector leader, and a growing urgency to meet circular economy demands. From Hedegaard's perspective, Saint-Gobain's engagement is driven by strategic necessity and environmental responsibility: "What has become clear to the company are two things: resources are becoming scarcer, and we want to stay relevant while continuing to grow" (Appendix 10.8). This reflects an apparent business urgency aligned with global sustainability trends.

While these strategic ambitions set the overall direction, Hedegaard also emphasizes that achieving circularity depends on overcoming practical, everyday barriers on construction sites. In the case of Hostrups Have, the idea to apply the Glass to Wool concept originated as an initiative from Isover itself, which had previously collaborated with the contractor Byens Tag & Facade on smaller projects involving glass recycling (Byenas, 2021). When Isover learned that Byens Tag & Facade had secured the main contract, they introduced the concept already during the planning phase. The contractor's familiarity with the method enabled a viable circular solution to be proposed early on, after which it was implemented in collaboration with Heimstaden as the client. Heimstaden has since stated that participating in the project was a natural decision once the proposal was presented, highlighting the appeal of the circular model due to its basis in a proven material with established functionality and safety (Heimstaden, 2024).

Image 6.10. Dismantled windows stored on pallets, waiting until enough have accumulated for efficient collection and transport, (Own photo)

Despite the early stage initiatives, significant practical challenges remain when circular solutions are implemented on-site. According to Hedegaard, one of the most pressing issues in renovation projects is the availability of storage space and the complexity of managing the entire logistics chain related to material collection and storage (Appendix 10.8). Limited on-site space often makes it challenging to find suitable locations for placing containers and pallets, for example, deciding where to temporarily store dismantled windows without obstructing ongoing activities. This challenge is illustrated in Figure 6.10, showing dismantled windows awaiting collection.

Hedegaard highlights the operational challenges of renovation projects in central Copenhagen, such as the long term occupation of multiple parking spaces. However, the complex logistics of coordinating material collection with freight carriers and ensuring timely pickups are the real complications: "It is a very practical issue. It can be difficult to get things picked up exactly when you need the space cleared. (...) It might be the last 10 pallets sitting on one or two parking spots, and they are supposed to be picked up tomorrow, but then we cannot come until next Thursday to collect them." These difficulties underline how circular initiatives often depend on precise timing and space management, which can be difficult to achieve in dense urban environments.

Although Saint-Gobain operates further down the construction value chain, Hedegaard stresses the importance of shared responsibility across stakeholders, especially when developers show genuine commitment: "Out of respect for Hostrups Have (...) we want to tell their story, because they actually wanted to do this" (Appendix 10.8).

At a structural level, Hedegaard also points to the economic barriers to circularity. Contrary to common assumptions, the value of circular materials is not inherent in the materials themselves but emerges through the labor, logistics, and coordination required to make reuse possible: "That is actually the whole misunderstanding about circular economy. Everyone focuses on the materials having a high value, but they just do not" (Appendix 10.8).

In this context, economic framing becomes significant for gaining stakeholder support. As Hedegaard explains, it is often a matter of presenting circular options clearly to decision-makers: "We need to help each other change behavior (...) present it to the developer like: for a bit more money, this can be done the right way, what would you rather do?" (Appendix 10.8).

In summary, Hedegaard and Saint-Gobain exemplify the definitive stakeholder role by combining strategic authority, environmental legitimacy, and a strong commitment to advancing circular practices within the sector.

Common traits of the definitive stakeholders

These stakeholders posses all three stakeholders of the salience model; urgency, power and legitimacy, which give them the opportunity and the responsibility to push circular solutions into practice.
A shared characteristic is that these stakeholders actively initiate or enable concrete circular initiatives by setting ambitious requirements, facilitating collaboration, or adapting existing frameworks. They demonstrate that sustainability relies not solely on technological innovation but also on strategic choices and collaboration across the value chain. Heimstaden and Gladsaxe Municipality are examples of using their positions to pave the way for new solutions, like reusing window glass and on-site reuse of building materials. Saint-Gobain, in turn, highlights how producers can support circular ambitions while also pointing to practical challenges in logistics and economics that require close coordination with developers.
There is also a shared recognition that the greatest barriers often lie in structural conditions, such as documentation requirements, certification systems, and cost structures, rather than in technical feasibility. Therefore, behavioral change, mutual understanding, and a willingness to invest some extra become central to achieving success.

From individual stakeholders to interconnected value chain

The analysis of stakeholder dynamics and the application of circular strategies in Børnehuset Svanen and Hostrups Have has illustrated how the transition toward circular construction intertwines with the roles, relationships, and interactions in the construction value chain. However, even when individual stakeholders express strong sustainability ambitions, structural barriers, and fragmented collaboration often limit the broader impact.

Summarizing

- Latent stakeholders have professional knowledge and legitimacy, but lack influence and power in the projects.
- Expectant stakeholders want change and have partial power, but are limited by structural and organizational barriers.
- Definitive stakeholders have power, responsibility and the opportunity to realize circular solutions, especially through early planning and demands.
- The projects show that circular strategies can succeed when strong and coordinated cooperation is established across the stakeholder roles.

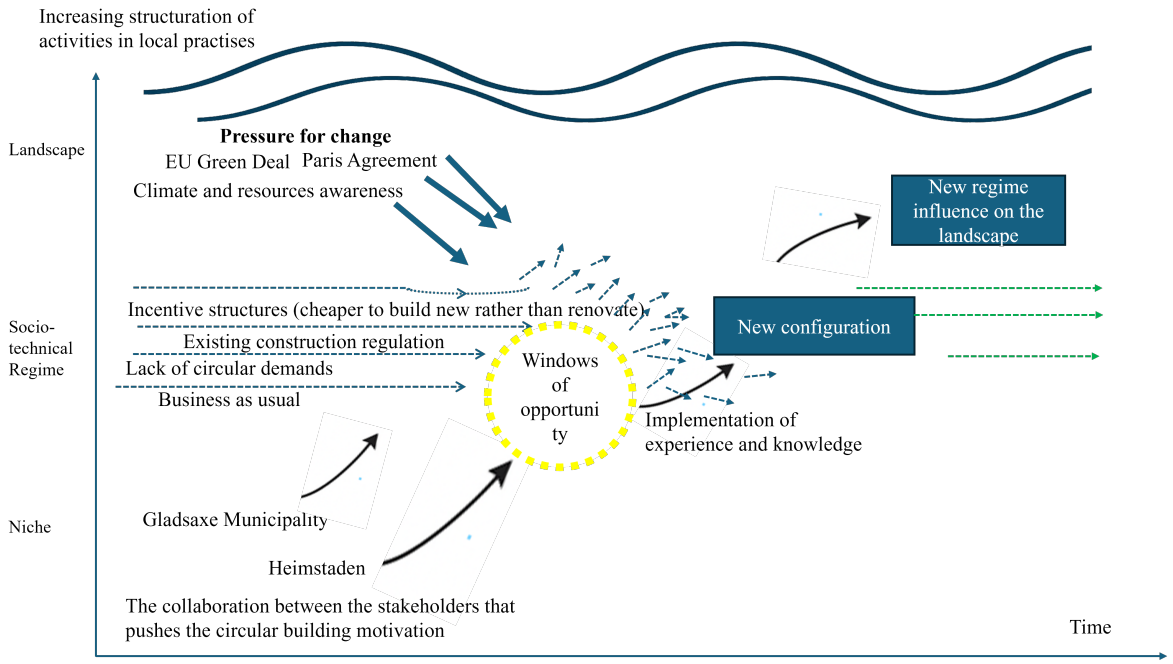
To understand how circular strategies can move beyond isolated successes and contribute to a systemic transition, the following chapter shifts focus from individual stakeholders to the relational dynamics and collaborative structures that shape the construction value chain.

Circular strategies as levers for a systemic transition

Circular construction is not only about applying new strategies but also about reshaping roles, responsibilities, and established practices across the value chain. Circular initiatives often remain isolated unless supported by systemic change. This chapter examines the conditions under which circular practices can scale and contribute to a more sustainable construction sector.

7.1 The Transition Perspective

To understand how circular strategies emerge and where they encounter resistance, in this section, the core concepts of the multi-level perspective (MLP) (Geels, 2011) are applied to the two examples, Børnehuset Svanen and Hostrups Have. By mapping stakeholders and activities across the three levels, the analysis explores how systemic conditions shape the practical implementation of circular construction. Figure 7.1 presents a simplified version of the MLP framework:



Figur 7.1

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The framework illustrated in Figure 7.1 serves as a conceptual structure for the subsequent analysis. It enables a differentiated understanding of how systemic conditions influence the implementation of circular strategies in the built environment.

7.1.1 Regimes, niches, and opportunities for change

Transition theory, as outlined in section 4.4, conceptualizes systemic change through the interaction between niche innovations, regime structures, and landscape-level developments. Based on the empirical material from Børnehuset Svanen and Hostrups Have examples, as well as interviews with stakeholders from across the construction value chain, the core concepts of the theory will throughout this section be used to explore where the circular strategies emerge and where they encounter resistance.

Figure 7.1 maps how the two cases relate to each of the three levels in the MLP framework. Landscape elements reflect broader societal or political pressures, regime elements capture dominant practices and institutional routines, and niche elements represent emerging innovations with the potential to reshape the status quo.

This mapping provides a conceptual starting point for analyzing stakeholder roles and systemic dynamics across the construction sector.

Transition Level	**Svanen (Gladsaxe Municipality)**	**Hostrups Have (Frederiksberg)**
Landscape	Political ambitions linked Local CO_2 goals Growing focus on sustainability in public construction	EU taxonomy and national climate policies Legislation driven pressure Societal awareness of resource scarcity
Regime	Institutional constraints in public procurement Documentation requirements Traditional role division in public projects Stability in municipal building practices	Conventional renovation processes Cost and efficiency dominate decisions Weak reuse incentives Standardized contractor roles
Niche	On-site reuse of materials from Gl. Gladsaxe School Internal cross-departmental collaboration Selective demolition efforts	"Glass-to-wool" innovation from Saint-Gobain Supplier-contractor partnership Uptake of niche solution in a large-scale context

Tabel 7.1. Application of transition theory across two empirical examples.

The table 7.1, provides only a partial picture, and to understand how these elements come into play requires attention to the people and organizations that interact within and across these levels. In the following section the focus will therefore be on the stakeholders identified in section 6.2 and examines their role in shaping or responding to the conditions at each level of the transition model.

7.1.2 Stakeholders across transition levels

The following section connects the identified stakeholders with the three levels of transition theory: landscape, regime, and niche. The aim is to understand how different stakeholders participate in the transition toward circular construction and how their position in the value chain affects cooperation, influence, and the ability to implement new practices. The investigation draws on interviews conducted, focusing on collaboration around material selection, measurement, storage, and documentation and communication between key stakeholders such as demolition firms and consultants.

Landscape-level

At the landscape level, the definitive stakeholders, Gladsaxe Municipality and Heimstaden, are key drivers of change. Their role as developers gives them the power and legitimacy to shape project ambitions in response to broader climate policy and sustainability goals. These stakeholders initiate circular ambitions, but external political or economic pressures shape their influence. Political disagreements in municipal city councils or delays caused by planning legislation can undermine sustainability goals. Even with formal authority, these stakeholders often face difficulties in translating long-term climate ambitions into practical results if there is a lack of support and coordination from the developer, consultants and suppliers.

Developing national and municipal climate targets places increasing pressure on developers and project teams. Several stakeholders point to how external requirements, like the need to document embedded carbon, are starting to influence design choices and material strategies. Although not always explicitly linked to the circular economy, these climate-related demands often initiate conversations across the value chain about recycling, documentation, and resource efficiency.

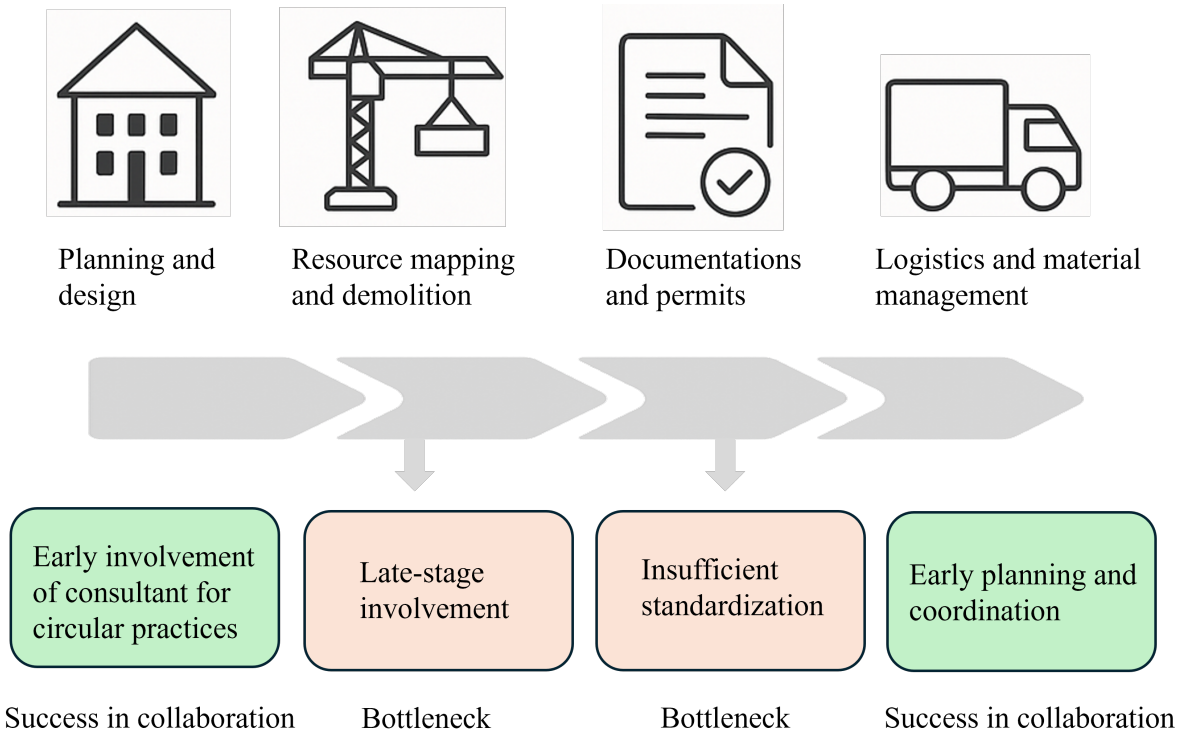
Regime level

At the regime level, the dominant structures and routines govern decision-making and collaboration in construction projects. These include procurement rules, standardized role divisions, documentation procedures, and short-term economic priorities. Across the case, stakeholders like advisors, engineers, demolition contractors, and knowledge institutions operate within this framework.

Unclear responsibilities, tight timelines, and a lack of standardized procedures for reuse often limit their ability to support circular ambitions. Demolition contractors, such as LH Hockerup, hold valuable knowledge about materials but are rarely involved early enough to influence design choices. Structural engineers can assess the technical viability of reused components but lack formal authority to demand reuse. Similarly, actors like Technological Institute provide expertise on documentation and material performance but are not systematically involved in the early planning stages where their input would be most impactful.

Several stakeholders point to poor coordination between project phases, where sustainability goals or material assessments fail to carry through the value chain. This leads to missed reuse

opportunities, especially when no one is responsible for documentation or follow-up. Figure 7.2 illustrates a typical reuse bottleneck within this regime structure.



Figur 7.2. Illustration of a reuse bottleneck in a circular construction project. (Own production).

Although reuse may be technically feasible, the absence of clear documentation responsibilities, misaligned timelines, and lack of coordinated planning between demolition and execution phases often lead to the discarding of reusable materials. This systemic issue was raised across interviews and represents a core regime-level challenge. As a result, even motivated stakeholders find it difficult to change practices within the current regime. This helps explain why circular solutions remain exceptions rather than the norm.

Niche level

At the niche level, experimental practices and new collaborations seek to challenge the dominant regime. These often involve pilot projects, innovative material solutions, or new partnerships that aim to promote circularity in construction. In both examples, niche stakeholders operate outside the established procedures and contribute knowledge, tools, and motivation, often without the formal authority or structural support needed to scale their efforts.

In Hostrups Have, Saint-Gobain's "glass-to-wool" solution is an example of a niche innovation that supports circular strategies. The technology exists, and a supplier is willing to collaborate, so here, the solution depends on the developer's willingness to integrate it into the project. Børnehuset Svanen's reuse efforts were enabled by selective demolition and internal collaboration within Gladsaxe Municipality. These practices reflect niche-level potential but also underline how fragile initiatives are when they depend on individuals or stand-alone projects.

Insights gathered from research and interviews indicate that valuable knowledge often resides outside the established regime. Anke Oberender from the Technological Institute illustrates this point: although she provides expertise on reuse and material documentation, she is not systematically involved in the early planning phases. Tight timelines, vague or inconsistent demand, and a lack of standardized tools constrain the ability of stakeholders to contribute meaningfully. She noted, “We can offer advice, but it only works when there is time and interest from the top” (Appendix 10.7).

The examples suggest that niche stakeholders hold important solutions regarding circular strategies, but their impact remains constrained without stronger connections to regime structures. Their innovations risk remaining isolated experiments unless supported by procurement requirements, economic incentives, or early-stage integration in the project planning process. These findings point to several recurring patterns in how collaboration affects the viability of circular strategies in practice.

Summarizing

- Circular strategies depend on early and trust-based collaboration throughout the value chain.
- Established roles and short-term economic logic often limit stakeholder engagement.
- Developers and project owners are central in facilitating shared circular visions.

While the transition perspective highlights structural conditions and innovation pathways, it does not fully account for the relational and collaborative dimensions that shape the everyday realities of circular construction. To better understand how circular strategies can move from niche experiments integration into established regime practice, the following section focuses on stakeholder relationships, dependencies, and forms of collaboration that support or hinder systemic change.

7.2 Relationships and collaboration in the circular value chain

This section investigates the role of relationships and collaboration in enabling circular construction. Drawing on the two case examples and stakeholder interviews, the analysis focuses on how power, influence, and trust can shape the implementation of circular strategies across the value chain. It builds on the previous transition analysis by focusing on interpersonal dynamics and organizational interdependencies that influence circular outcomes.

The transition from niche innovations to mainstream adoption within the construction sector depends on technological solutions and the dynamics between stakeholders in the value chain. Relationships and collaboration across stakeholders are vital in bridging the gap between isolated circular initiatives and systemic change.

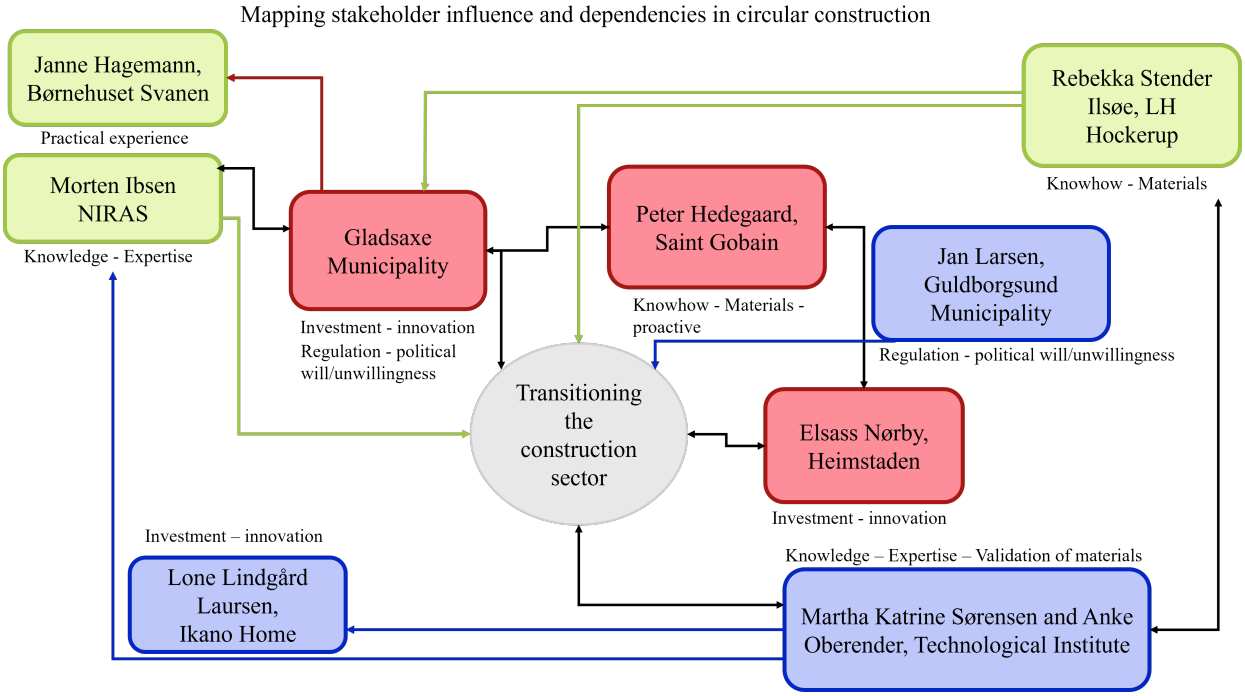
The case examples demonstrate that effective circular construction requires more than technical coordination or financial incentives. It depends on trust, shared ownership, and a precise distribution of responsibilities (Freeman, 1984; Geels, 2011). Developers and project owners often

need to adopt a more proactive role to integrate circular initiatives early in the process (Concito and Build, 2023).

To illustrate how collaboration and influence manifest across the value chain, the following overview summarizes key stakeholder dependencies, as identified in interviews:

- **Producers → Developers:** Influence material availability and innovation.
- **Knowledge actors → All:** Provide technical advice but often lack early involvement.
- **Municipalities → Developers:** Set regulatory frameworks and political ambitions.
- **Certification bodies → Developers:** Define sustainability criteria and project legitimacy.

These dependencies vary in strength and formality but collectively shape how circular strategies are implemented in practice. Figure 7.3 visualizes these relationships based on the Salience Model stated in theory, 4.3.1). Proximity to the center indicates relative influence, while arrows represent key relational dependencies. The black arrows denote mutual influence or interdependence. The colored arrows correspond to the respective color of the stakeholder and indicate a one-way dependency, where the stakeholder relies on the input, decisions, or actions of the other stakeholders.



Figur 7.3. Mapping stakeholder influence and dependencies in circular construction, based on the Salience Model (Freeman, 1984), (Own production).

This visual map provides a basis for the following section, which investigates how these dependencies translate into concrete conditions for collaboration in practice.

7.2.1 Success criteria for the implementation of circular strategies, based on the interviews

Circular transformation requires that relationships in the value chain change their nature, from being characterized by narrow economic interests and fixed roles to supporting dialogue, shared ownership, and collaboration on new solutions (Freeman, 1984; Kirchherr et al., 2017). Isolated ambitions among individual stakeholders are insufficient; the transition requires transformed interactions that support shared responsibility and coordinated action (Concito and Build, 2023; Circle Economy, 2023).

In this context, the case examples suggest a set of success criteria that may influence whether these new forms of collaboration can emerge and support circular practices in reality. These criteria do not separate from the relational dependencies illustrated in Figure 7.3; instead, they provide a concrete understanding of how dependencies must evolve to support the transition toward circular construction.

1. Early Involvement and Shared Ownership
As previously explained in section 7.2, early involvement is a recurring theme in ensuring successful circular collaboration (Geels, 2011). The following examples illustrate how this unfolded in practice.

Børnehuset Svanen provides a clear example of how Gladsaxe Municipality, acting as landowner and developer, created the conditions for early dialogue and selective demolition planning (Jan Rasmussen, 6.2). However, in this case, the potential for interior material reuse was overlooked because design decisions had already limited the scope for refurbishment and design for disassembly, as further elaborated in section 7.3.1. In contrast, is Hostrups Have, where early collaboration between Heimstaden and Saint-Gobain enabled the integration of innovative solutions as the "glass-to-wool" initiative, underlining how shared ownership of sustainability ambitions, established through proactive dialogue can unlock new pathways for circular practices (Hedegaard, 6.2).

2. Economic Incentives and Regulatory Support
Even with motivated stakeholders, economic and regulatory frameworks frequently hinder the realization of circular solutions (Concito and Build, 2023; Circle Economy, 2023; Kirchherr et al., 2017). The case examples and interviews demonstrate how economic and regulatory complexities subtly uphold linear practices over circular alternatives.

Without stronger regulatory demands and market incentives, the value chain prioritizes immediate cost savings over long-term sustainability goals (European Commission, 2022). As illustrated in figure 7.3, the transition involves a wide range of interlinked stakeholders who often act within fragmented or misaligned frameworks. What the European Commission highlights as missing is precisely the combination of clearer **regulation, common standards,** and **economic instruments**, that can turn these actor constellations into coordinated transition mechanisms. Developers and policymakers, therefore, play an important role in adjusting procurement processes and introducing fiscal incentives, such as differentiated taxation, mandatory reuse quotas, or subsidies for circular initiatives, to realign economic interests with circular ambitions, as further elaborated in section 7.3.3.

3. Practical frameworks for material reuse
Finally, practical barriers, such as insufficient storage capacity, lack of standardized documentation, and unclear responsibilities for material assessment, can often disrupt circular collaboration (Oberender and Ilsøe, 6.2 and 6.2). These challenges undermine the interdependencies illustrated in Figure 7.3, where effective coordination between stakeholders preserves the value of materials throughout all project phases and over time. As further elaborated in Section 7.3.3, "the availability of on-site storage proved to be a decisive enabler of material reuse in the Børnehuset Svanen project, illustrating a rare but significant success factor"(Rasmussen, 6.2). However, practical challenges continue to influence whether circular ambitions can be scaled in practice or remain confined to isolated project examples (Concito and Build, 2023).

These success criteria illustrate that effective collaboration in the circular value chain depends on who is involved and how and when they engage with each other. This perspective is reflected in the following analysis of how circular strategies were applied in practice across the case examples.

Summarizing

- Early involvement and shared ownership enable circular solutions from the start.
- Economic incentives and regulation must support circular choices.
- Practical frameworks such as storage space and documentation are significant for the reuse of materials.

7.3 Application of Circular Strategies in Practice

This section examines the application of circular economy strategies in the two case examples, focusing on how the R-strategies and the principles of narrowing, slowing, and closing loops are interpreted and challenged in practice (Kirchherr et al., 2017).

A generic process model has been developed to provide a structured foundation for the analysis, outlining the key phases of a construction project (Kirchherr et al., 2017; The Ellen MacArthur Foundation, 2024). This model is a framework for exploring how and when different circular strategies can be applied throughout the value chain (Geels, 2011; Concito and Build, 2023). Combining the process model with the R-strategies and the circular economy categories makes it possible to identify central moments for intervention and collaboration between stakeholders (Freeman, 1984).

Figure 7.4 presents a visual overview of how circular strategies, grouped under narrowing, slowing, and closing, can be integrated across the phases of a construction project. It is an analytical framework for understanding when and how different interventions can occur.

Figur 7.4. Integration of R-strategies across project phases (Own production).

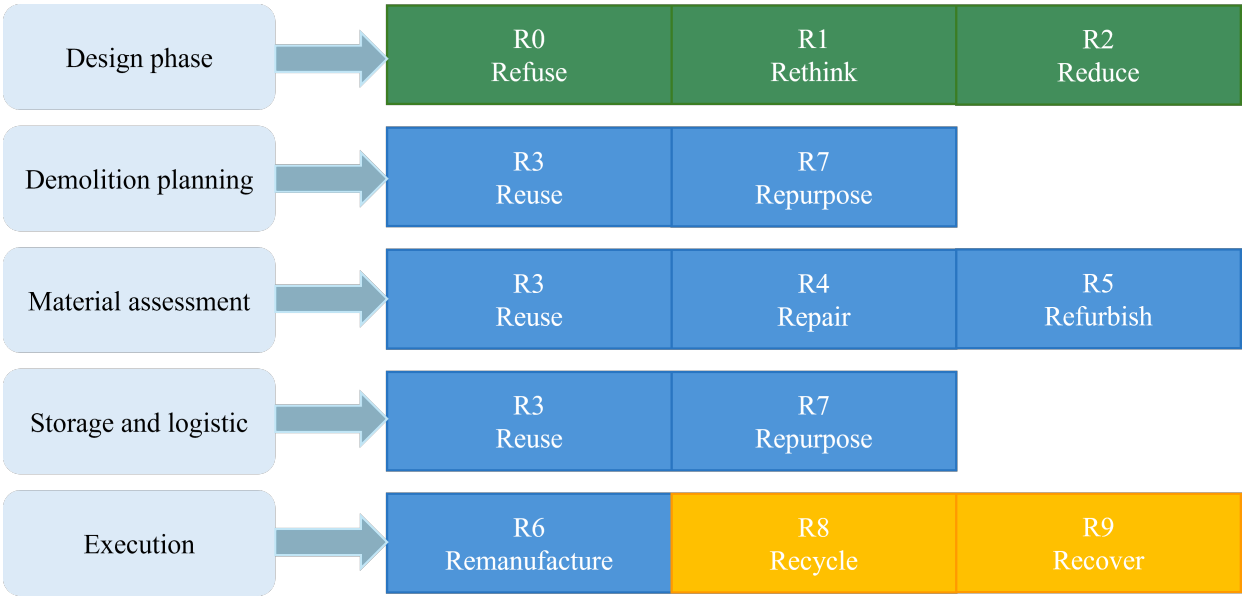


Figure Legend

Narrowing: Strategies aimed at smarter product use and reducing material consumption (R0–R2).

Slowing: Strategies focused on extending the lifespan of products and materials (R3–R7).

Closing: Strategies related to recycling and recovering materials at the end of their lifecycle (R8–R9).

Design Phase:
This is the stage where project visions are translated into concrete designs. Early decisions about materials, building methods, and circular ambitions are made, often determining the scope of circular solutions later in the process. Definitive stakeholders heavily influence this phase as developers and municipalities (e.g., Heimstaden and Gladsaxe Municipality, (6.1.2, 6.2), who possess the power and legitimacy to set circular ambitions from the outset. However, latent stakeholders like end-users (e.g., Janne Hagemann 6.2) and sustainability advisors are often excluded at this point, despite having valuable knowledge about long-term functionality and operational sustainability (Freeman, 1984; Ronald K. Mitchell and Wood, 1997).

Demolition Planning:
Focuses on planning the deconstruction process to maximize material recovery. The early involvement of relevant stakeholders is significant in identifying reusable materials and planning selective demolition accordingly. This phase highlights the importance of involving expectant stakeholders as demolition contractors (e.g., LH Hockerup, 6.2) and consultants (e.g., NIRAS, 6.2), who possess knowledge about material recovery but often lack decision-making power. When these stakeholders are not engaged early, opportunities for material reuse are frequently missed (Ibsen and Ilsøe, 6.2, 6.2).

Material Assessment and Measurement:
It involves evaluating materials' quality, quantity, and suitability for reuse. Requires transparent

responsibility allocation and reliable documentation to ensure materials meet safety and regulatory standards. Responsibility in this phase often remains unclear, leading to a lack of ownership. Expectant stakeholders like the Technological Institute are central in providing documentation and ensuring compliance. However, their recommendations only have effect if definitive stakeholders prioritize and demand proper assessments (Oberender and Sørensen, 6.2, 6.2).

Storage and Logistics:
Covers the practical handling of materials between demolition and reuse. Efficient storage solutions and coordinated logistics are used to maintain material value and prevent waste. This phase highly depends on definitive stakeholders who can provide space and financial resources for temporary storage (e.g., Gladsaxe Municipality and Børnehuset Svanen, 6.2). At the same time, logistical partners and material producers like Saint-Gobain act as expectant stakeholders facilitating circular solutions through innovation but are often limited by practical barriers related to site access and storage capacity (Hedegaard, 6.2).

Execution:
The construction or renovation phase is where planned circular solutions are implemented. Success depends on the willingness and ability of the stakeholders to prioritize reused materials and ensure proper documentation. Stakeholders and suppliers are key in implementing the planned circular strategies at this stage. Their role as expectant stakeholders means they may have high legitimacy and urgency but often lack the power to deviate from established plans unless the developer actively supports and enforces circular requirements (Concito and Build, 2023; Circle Economy, 2023).

The phases illustrate how the timing and form of stakeholder engagement shape whether circular strategies are realized as opportunities and constraints unfold dynamically across the project. The following explores how these dynamics played out in practice across the two case examples.

7.3.1 Applied Strategies and outcomes

Building on the success criteria, the following section examines how these strategies materialized in practice through narrowing, slowing, and closing approaches (Kirchherr et al., 2017; The Ellen MacArthur Foundation, 2024). This includes an assessment of the practical barriers that limited the implementation of higher-order strategies, as well as the contextual stakeholders that enabled specific circular solutions to emerge.

Narrowing
Regarding narrowing strategies, the two projects reflect different approaches to integrating circularity. At Hostrups Have, early collaboration between Saint-Gobain and Heimstaden led to a rethinking of material choices and ambitions, showing how shared ownership and early dialogue can shape design decisions (Hedegaard, 6.2).

At Børnehuset Svanen, circularity was embedded from the outset through Gladsaxe Municipality's policy to integrate sustainability and the Nordic Swan Ecolabel in all daycare projects (Rasmussen, 6.2). This ambition informed design and procurement processes, including procedural flexibility that allowed materials to be identified before final design decisions were made (Ibsen, 6.2).

To support reuse, demolition, and new construction were treated as parallel processes, enabling material planning before the final design was completed (Appendix 10.1). This reflects a clear

intervention in the Design Phase (Figure 7.4). Despite these efforts, some narrowing strategies, like reducing the use of new materials indoors, were limited by certification requirements and material availability (Hagemann, 6.2).

Slowing

The principle of slowing material flows was more visibly applied at Børnehuset Svanen to reuse exterior materials. Roof tiles from the former school were creatively reused as facade cladding and roofing materials, while bricks were repurposed as flooring in the greenhouse area, as seen in Figures 7.2 and 7.1. These examples show how the lifespan of materials can be extended when time, space, and planning allow for it.

The reuse of roof tiles and bricks mainly occurred during the storage, logistics, and execution phases, where practical solutions for material handling and incorporation into the new design were implemented. As illustrated in Figure 7.4, these phases represent key moments for extending material lifespans when early design considerations have already imposed certain limitations.

Image 7.1. Roof tiles that now also function as facade cladding, (Own photo).

Image 7.2. Former bricks from the school now serve as flooring in the 'greenhouse' (Own photo).

Despite the high ambitions of the project, Børnehuset Svanen made limited use of strategies such as refurbishment and design for disassembly. As previously noted, the potential for interior material reuse was constrained by early design decisions, limiting opportunities to apply slowing strategies beyond symbolic material reuse (Hagemann, (Appendix 10.4).

At Hostrups Have, slowing strategies were similarly limited by practical and regulatory constraints. Instead, efforts focused on introducing a new circular material solution through the "glass-to-wool" initiative (Hedegaard, (Appendix 10.10). This illustrates how material innovation can take

precedence over extending the lifespan of existing components when older elements fail to meet modern energy efficiency and safety standards.

While Hostrups Have formally applied a closing strategy by recycling the discarded glass into new insulation materials, this solution also challenges the strict categorization of circular strategies. Because the recycled material was directly reintegrated into the same building as insulation, it effectively extended the functional life of the material within the built environment. This blurs the boundary between closing and slowing strategies, illustrating how circular practices in reality often combine elements of both.

Closing
Both case examples involved the closing strategy, as some of the demolished materials were sent to incineration for energy recovery. However, as illustrated in figure 7.4, recovery is positioned closer to the linear economy and does not align with the higher ambitions of a circular approach. As recovery technically falls under the closing strategy, it depends on the continued generation of waste and thereby contradicts the core principle of circularity, which aims to eliminate waste altogether (**?**). The transition toward circular construction could therefore focus on strategies with higher circular value, such as reuse and refurbishment.

7.3.2 Missed Opportunities and Reflections

Revisiting the process model (figure 7.4), the analysis shows that the timing of circular considerations strongly affects whether strategies are implemented in practice. At Børnehuset Svanen, early ambitions for reuse created more favorable conditions, while later-stage considerations at Hostrups Have offered fewer opportunities for meaningful intervention.

Figure 7.2 offers a comparative overview of these patterns, showing which project phases' circular strategies were actively pursued and where barriers prevented their implementation. Rather than following a linear logic, the table illustrates how the practical realization of circularity is unevenly distributed across phases and shaped by structural constraints and project-specific decisions.

Higher-order R-strategies remained underused in both cases, such as refuse, reduce, and refurbish. In the design phase, a lack of processes for refurbishment and disassembly limited both projects' ability to slow material flows (Kirchherr et al., 2017; The Ellen MacArthur Foundation, 2024). While symbolic reuse (e.g., bricks and tiles) was achieved, more systemic integration was largely absent. This reflects a transitional stage in the sector, where reuse and repurposing dominate, while more profound circular changes are often postponed (Kirchherr et al., 2017).

Tabel 7.2. Circular strategies applied across project phases in Børnehuset Svanen and Hostrups Have.

Phase	**Børnehuset Svanen**	**Hostrups Have**
Design Phase	✓ Circularity integrated conceptually; reuse planned from outset.	✗ Focus on aesthetics and new materials; circularity introduced later.
Demolition Planning	✓ Early planning with space for material storage ensured reuse.	✗ Late involvement of recycling solutions; limited planning for reuse.
Material Assessment	✗ Limited reuse of interiors due to material availability and certification constraints.	✓ Glass recycling identified and assessed early in collaboration with Saint-Gobain.
Storage and Logistics	✓ On-site storage enabled reuse of materials like bricks and roof tiles.	✗ Space constraints and difficult logistics for material pickup and temporary storage.
Execution	✗ Interior reuse limited; aesthetics and certification prioritized over refurbishment.	✓ Glass-to-wool initiative successfully implemented; circular material flow achieved.

✓ = Realized ✣ = Partially achieved / constrained

These findings raise questions about the practical distinction between reuse and repurpose strategies. When reclaimed bricks are used as flooring rather than in walls, or when roof tiles are transformed into facade cladding, it becomes unclear whether the material has truly changed its purpose or application context. Examples illustrate how circular practices in reality often blur the boundaries established by theoretical models (The Ellen MacArthur Foundation, 2024). This suggests that the central focus should not be on precise classifications but on preserving material value and extending product lifespans, regardless of the specific strategy label applied.

Summarizing

- Circular strategies are implemented differently across phases and projects, depending on early ownership and practical frameworks.
- Theoretical distinctions between strategies are blurred in practice, where solutions often combine elements from multiple strategies.
- The value lies not in the classification, but in the extension of the life and function of materials.

To better understand how circular practices can move beyond symbolic reuse and toward more systemic change, it is necessary to examine where and how "windows of opportunity"emerge within the construction process.

7.3.3 Examples of windows of opportunities from the case examples

Transitions toward circular construction rarely follow a linear path but depend on moments where political pressure and market readiness align to create windows of opportunity (Geels, 2011). According to the multi-level perspective (MLP), these windows emerge when landscape-level developments destabilize established regimes, allowing niche solutions to gain traction if the right conditions are present 4.4.

Political and regulatory developments are currently among the most significant forces opening these windows. The introduction of the EU Taxonomy and mandatory CO_2 emission requirements for new buildings exert external pressure on the construction sector, forcing developers and project teams to reconsider material strategies and long-term planning. Simultaneously, market dynamics are shifting as demand for sustainable solutions grows, making circular practices more attractive from a competitive perspective.

How the examples become windows of opportunity
Findings from the Hostrups Have case illustrate how these dynamics can be activated through early and integrated collaboration. The partnership between Heimstaden and Saint-Gobain shows that circular solutions can become more possible when stakeholders from across the value chain are involved at the outset. This points to a window of opportunity, the project challenged conventional procurement practices and demonstrated that alternative collaboration models are possible and can unlock circular solutions at scale.

Another opportunity emerges through shifting societal expectations. In Hostrups Have and Børnehuset Svanen, stakeholders referenced an increased focus on sustainability among investors and contractors. This cultural shift at the landscape level creates influence and market incentives for developers to engage in circular initiatives visibly. In this way, sustainability is a compliance issue and a branding and positioning strategy, potentially providing a competitive edge. Nevertheless, as Hedegaard cautions, opportunities are fragile, without changes to procurement, planning, and incentives, successes remain exceptions, not drivers of systemic change.

Børnehuset Svanen, demonstrates that regime barriers can be overcome under the right conditions. Gladsaxe Municipality's dual role as landowner and developer enabled early planning and practical solutions, including on-site material storage, which are actions that are rarely possible in projects governed by conventional role divisions and procurement rules. Although technological solutions for documentation and material assessment are often said to be available, their application remains inconsistent and fragmented. As Oberender notes: "We don't lack solutions; we lack the willingness and structures to apply them." (Appendix 10.7). Unlocking the full potential of circular construction requires more than technical fixes, it demands new workflows, clearer roles, and strong incentives to act when windows of opportunity open before the moment passes.

Summarizing

- Windows of opportunity arise when landscape pressures destabilize the regime and when niche innovations are mature enough to respond.
- Seizing them requires coordination across all levels of the transition model.
- Without adaptive procurement, economic incentives, and strong collaboration, circular efforts remain isolated.

Discussion of key insights

Despite increasing attention to circular construction, the implementation remains fragmented. To understand why circular strategies often fall short of systemic impact and what conditions are needed to change that, the discussion is structured around four interlinked themes that emerged from the empirical material. These themes respond directly to the third sub-question:

What is holding back the transition to a more circular construction practice, and what are the main barriers?

The aim of structuring the discussion thematically is to reflect the interconnected nature of the barriers identified across both case examples. Rather than examining individual elements in isolation, the thematic structure makes it possible to trace how key factors interact across different levels of the socio-technical system. The structure was chosen to reflect the circular transition's complexity and clarify where targeted interventions might have the most significant transformative potential.

8.1 Legislative frameworks as levers or limitations

The legislative frameworks play a complex and, at times, paradoxical role in the circular transition within the construction sector. On the one hand, the EU Taxonomy and the CSRD function as drivers, setting clear expectations for future reporting on climate impact and sustainability (Section, 2.2.2). To some extent, these requirements have helped raise awareness of circular solutions among large and small stakeholders, signaling that sustainability is no longer optional but a requirement.

On the other hand, legislation is often experienced in practice as fragmented and unpredictable, as the Omnibus regulation illustrates well (Section, 2.2.2). Initiatives like "Stop the Clock"temporarily postpone certain reporting obligations and create uncertainty among companies and advisors. This unpredictability makes it difficult for stakeholders to plan long-term or invest in new solutions, thereby hampering the implementation of circular strategies.

Several stakeholders describe a tension between their willingness to comply with current and upcoming regulations and the practical challenges involved. This raises the question of whether it is truly a lack of willingness that hinders circular progress or, rather, a response to the uncertainty and financial risks associated with circular solutions. Instead of moving forward, stakeholders often remain caught between stated ambitions and practical hesitation.

This dynamic is not new. Transition studies, including the Multi-level perspective, have for decades highlighted how systemic transformation requires more than high-level targets; it demands sustained support for experimentation, learning, and niche development (Geels, 2002). However,

despite this extensive body of knowledge, regulatory frameworks continue to fall short of supporting the structural change they aim to achieve.

As a result, even stakeholders with circular ambitions feel obligated to opt for linear solutions, as they are perceived as faster, cheaper, and more reliable. This illustrates what the literature refers to as an incentive paradox: while regulations formally promote circularity, they, in practice, reinforce linear behavior (Kirchherr et al., 2018).

Furthermore, the analysis shows that this tension is not merely a matter of technical regulation but also of how regulation is understood and applied in practice. Several interviewees stressed that regulation should not only be about control and compliance but should also function as an enabling and guiding force. If legislation is linked to tools such as financial incentives and consistent procedures, it can help reduce uncertainty and thereby strengthen trust and the ability to think circularly from the outset.

The Reduction Roadmap is a strategic policy document introduced in Denmark's climate strategy. It sets targets for reducing climate impacts across sectors, including construction, and serves as a reference for future regulations on material consumption, resource efficiency, and documentation (Reduction Roadmap, 2023). The roadmap has influenced the construction sector, as BR23 (Transportministeriet, 2023). This has led to a tightening of the requirements but also served as an eye-opener for decision-makers by revealing that regulatory demands alone are insufficient; they must be accompanied by mechanisms that actively support actors in making the transition. Without transitional tools and nudging, the initiative risks becoming purely symbolic.

This underlines the necessity of rethinking the role of regulation, not simply as a constraint on businesses but as a dynamic part of the innovation system (Geels, 2011). If the goal is to promote genuine systemic transformation in the construction sector, particularly in a Danish context marked by high ambitions but uneven implementation. In that case, the regulatory design must impose demands and create space for experimentation and learning. Only in this way can legislation function as a catalyst and a compass for the circular transition.

In summary

- Regulations create momentum and uncertainty.
- Unpredictability limits investment in circular solutions.
- More supportive and transparent policies are needed.

8.2 From niche projects to systemic change

Both case examples illustrate that successful circular solutions often depend on specific conditions, like access to temporary storage space or the involvement of passionate individuals with specialized knowledge and commitment. For instance, for Børnehuset Svanen, the initiative succeeded "because there was time and space" 6.2, which several interviewees also pointed out as an exception in the construction sector. This supports the MLP's argument that niche innovations require protection to grow and mature. However, it also raises the question of whether protection is scalable in a commercial context—or whether it remains the privilege of specially funded or municipally

supported demonstration projects. What are the realistic prospects for broader transformation if circular practices depend on exceptional conditions?

When circular practices depend on rare conditions, it raises doubts about their potential to succeed on a broader scale. However, these exceptions can act as important testing grounds, showing what is possible and informing systemic change. The goal is to shift from viewing circularity as exceptional to making it part of the norm. While challenges remain, the prospects are realistic if structural conditions evolve to support circularity as standard practice.

Although stakeholders in both projects demonstrate interest and willingness to work more circularly, they are met with resistance from regime-level structures. Tight schedules, economic models, lack of documentation, and commercial risks reinforce linear practices, not necessarily because stakeholders oppose circular solutions but because the system does not reward them. This aligns with the MLP, as regime stability persists not out of resistance to innovation but because embedded routines make change difficult.

This interpretation challenges the assumption that stakeholder resistance is the main barrier to circular construction. If opposition is not ideological but rooted in practical conditions, could relatively modest interventions be enough to shift current practices? Or does the persistence of structural barriers, even in projects with strong ambitions, suggest that more fundamental disruption is needed? The examples indicate that without deliberate efforts to dissettle established routines and support new forms of collaboration, local commitment alone is unlikely to initiate a systemic change.

However, this also prompts a critique of the applicability of the MLP model. While the model typically describes systemic change as a process where niches gain momentum and pressure the regime, in practice, it becomes difficult to identify how this "hole in the socio-technical landscape" emerges and becomes institutionalized. One exception might be resetting the CO_2 impact of reused materials in the Danish LCA regulation, (Trafikstyrelsen, 2022), representing a rare instance where a landscape-level policy change directly enabled niche practices. The interviews highlighted a key challenge despite the regulatory change resetting the CO_2 impact of reused materials, its practical effect has been limited. Several stakeholders pointed out that the market for reused materials remains underdeveloped and lacks the volume needed to drive widespread change 6.2. There is a lack of scaling, and knowledge and experience from niche projects are rarely transferred or formalized within the socio-technical regime or landscape. Several stakeholders noted that learning is often project-bound and rarely shared or integrated into future practices. 6.2.

This raises the question: If bottom-up and top-down initiatives struggle to create lasting structural shifts, what kind of mediating mechanisms or institutional frameworks might be needed to bridge the gap between niche experimentation and regime transformation?

In summary

- Niche projects lack structures for scaling.
- Knowledge often remains project-bound.
- Regime change requires more systematic learning.

8.3 Stakeholder collaboration and conflicting priorities

Resource efficiency is not merely a technical challenge, as noted by Kirchherr et al. (2018) and further confirmed by Oberender (Appendix 10.7), but largely a matter of collaboration and coordination across internal and external value chains. In the case examples, it became evident that these power dynamics do not align with the formal project structure. On the contrary, Janne Hagemann explained that her input was overlooked despite having the most comprehensive understanding of how the building would function in everyday use.

Municipalities often distance themselves from responsibility by pointing to a lack of political will or financial flexibility, as seen in the case of Guldborgsund Municipality 6.2, which has experienced limited external pressure. This absence of accountability and external pressure reflects a structural imbalance, where the system becomes a barrier to transformation. Contractors and advisors also operate within narrow mandates, limiting the coordination of circular goals across the value chain. This prompts whether broader and earlier stakeholder engagement is necessary to overcome structural fragmentation and enable more systemic change. (Section 6.1.3).

This challenges the need for a more dynamic understanding of stakeholder roles and their influence and potential in driving change. Although many interviewees expressed general support for increased resource efficiency and reuse, the cases of Hostrups Have and Børnehuset Svanen reveal that stakeholders interpret circularity differently. Gladsaxe Municipal representative noted that circularity was primarily seen as "fulfilling the requirements for certification." In contrast, technical consultants emphasized long-term reuse potential and material durability (Appendix 10.9) and (Appendix 10.1). These diverging understandings contributed to friction in the decision-making process and made working toward shared circular goals difficult.

Developers and municipal representatives prioritize financial security and strict adherence to project timelines. At the same time, consultants and technical experts are more likely to emphasize the long-term value of innovative solutions (Appendix 10). This leads to an asymmetry between knowledge and decision-making power, where those with insight into material durability and circular potential are not given sufficient influence in the planning process. Without alignment between these perspectives, circular ambitions risk becoming fragmented or sidelined. If incentive structures and regulatory frameworks do not evolve accordingly, conflicting priorities may persist and intensify.

In the absence of clear standards or supporting incentives, many stakeholders revert to familiar practices. Several interviewees from Hostrups Have, and Børnehuset Svanen noted that this often means relying on conventional linear procedures—even when interest in circular alternatives exists. These choices reflect not a lack of ambition but institutional constraints, budget structures, and time pressures that restrict room for experimentation. (Section, 6.1.3).

The interviewees also noted that the absence of clear guidelines or economic leeway makes it difficult to argue for circular solutions internally, especially when these choices increase uncertainty or project risk (Section 6.1.3). In this way, stakeholders reproduce the practices they wish to challenge, not because of resistance but because the systems around them offer limited support.

In summary

- Misalignment and asymmetry hinder collaboration.
- Budgets and timelines outweigh circular ambitions.

8.4 Does circularity stops at repurpose?

The R-strategies have been presented as a framework for internalization circularity, from Refuse to Recover, as explained in section 4.5, but as demonstrated throughout the thesis, only the most accessible strategies are typically applied in practice, as repurpose and to some extent, reuse. Other strategies, including refuse or refurbishing, remain largely unrealized despite being not only for transitioning the construction sector but also for redefining the norm in building practices. This limited uptake reflects a broader tendency to prioritize the narrowing of resource flows, like using fewer or more efficient materials, over closing the loop through actual reuse and refurbishment. Although narrowing strategies fit within existing workflows more easily, they rarely challenge the linear structures that dominate construction. In contrast, closing the loop requires early coordination, new forms of collaboration, and a willingness to engage with logistical and legal uncertainty. These conditions were largely absent in both case examples.

This tension between stated ambitions and actual practice leads to a broader question: Why do more transformative strategies remain unrealized, even in projects that claim to prioritize circularity?

The interviews point to several reasons why ambitious R-strategies remain underutilized in practice. A key barrier is the lack of economic incentives and structural support for solutions that involve redesigning or navigating uncertain approval processes. In addition, many stakeholders expressed concerns about documentation requirements and legal accountability, which created further hesitation. As one Morten Ibsen noted, it is often “easier and cheaper to choose new materials,” (Appendix **??**), even when the benefits of reuse or repurposing are acknowledged. This illustrates a broader pattern identified in the analysis (section 6.1.3), where cost efficiency and risk aversion frequently outweigh circular ambitions in practice.

What emerges from this study is a persistent gap between theory and practice, where circular elements are often introduced as isolated features rather than embedded in a broader transformation of construction practices. This leads to a reevaluation of how R-strategies are implemented, not as a checklist but as an integrated part of design, planning, and collaboration.

One initiative is the Reduction Roadmap, which supports the development of incentives and tools to promote a more ambitious and holistic application of circular strategies, as further elaborated in section 8.1. In light of the implementation challenges discussed above, these frameworks offer more than just technical guidance, and they act as catalysts for sector-wide transformation by making the scale of necessary change tangible and measurable.

In 2023, average emissions from Danish construction were 12 kg CO_2e/m^2/year. The updated Roadmap 2.0 sets a new benchmark of 5.8 kg CO_2e/m^2/year, aligning with the targets of the Paris Agreement. The fact that no significant global reductions have been achieved in the past two years only adds to the urgency of implementing strategic frameworks (Reduction Roadmap,

2023).

While the Roadmap sets an ambitious benchmark, it has also been criticized for lacking clear implementation pathways and for underestimating the systemic changes required. Achieving the Paris Agreement targets will demand more than gradual improvements. It will likely require a fundamental shift from continued use of virgin materials and standard linear practices. Without stronger regulation and structural changes, the goals outlined in the Roadmap risk remaining aspirational rather than actionable. (Adolfsen, 2024; Kej, 2024).

In summary

- Only the easiest R-strategies (Recycle and Recover) in the closing loops are applied 4.4.
- Financial uncertainty and regulation deter ambitious efforts.
- Strategies should be integrated earlier in the process.

8.5 Reflection on the thesis

This thesis started by investigating how circular strategies are applied in practice. It did this through an analytical lens that combines stakeholder theory with the multi-level perspective, offering valuable insights into the power dynamics, interdependencies, and systemic tensions that influence the circular transition in the construction sector.

One limitation is the lack of attention to user experiences, aesthetic considerations, and design decisions. This was particularly evident in the case of Børnehuset Svanen, where the absence of an interview with Lendager Group limited our understanding of how circular ambitions were translated into architectural and material choices.

At the same time, the interviews revealed what initially appeared to be a paradox: while many stakeholders expressed strong support for circular construction, they often made decisions that maintained linear practices. This paradox becomes more understandable in light of financial constraints, institutional habits, and risk perceptions, factors that complicate the shift from ambition to action. It raises the question of whether current research and governance frameworks adequately account for these normative and behavioral dimensions.

While the influence of economic factors on circular construction is widely acknowledged, the interviews clarified how dominant they remain in practice. Although financial considerations were not initially integrated as a primary analytical dimension, they gradually emerged as a recurring theme, shaping what is considered feasible, desirable, or even discussable. Several interviewees pointed to limited budgets and complex approval systems as key barriers. A more explicit integration of economic structures, particularly regarding municipal budget frameworks, could have allowed for a more realistic assessment of which circular strategies are scalable.

The initial ambition to investigate supply and demand dynamics in the reused materials market, like reclaimed bricks or flooring, ultimately gave way to a focus on stakeholder roles and decision-making processes. In hindsight, a more detailed investigation of material flows and market volumes might have enriched the understanding of logistical and infrastructural bottlenecks. While the thesis touches on issues such as storage and resource mapping, it does not fully unpack how

market mechanisms condition the viability of circular solutions.

Finally, the role and integration of theory emerged as a point of reflection. In working with stakeholder theory and the Multi-Level Perspective (MLP), it became evident that theory is not a neutral tool. Whether theory should function primarily as an interpretive lens, an explanatory model, or a structuring analytical framework, this illustrates a broader challenge in transition research, the difficulty of balancing analytical rigor with empirical complexity in a rapidly evolving field. Rather than serving as a rigid structure imposed on the data, the theory might more usefully be understood as a conversational partner that evolves alongside the empirical material.

A complex interplay between stakeholder roles, institutional dynamics, and incentive structures shapes the implementation of circular strategies in the construction sector. While individual projects demonstrate that change is possible, systemic barriers continue to confine circularity to niche initiatives and voluntary efforts rather than embedding it in mainstream practice.

In summary

- Structural constraints and financial pressures explain the gap between circular ambitions and actual practices.
- A stronger focus on economic conditions and material markets could have enriched the analysis.
- Theory should be used as a flexible lens, not a fixed framework.

These insights highlight the need for a more coherent and supportive framework regarding economic incentives and a shared understanding of resource scarcity and climate urgency as drivers of the transformation. Based on this, the following conclusion summarizes the main findings and discusses their broader implications.

Conclusion and further perspectives

This thesis set out to answer the following research question:

How does the transition toward circular construction practices affect the collaboration and stakeholder roles across the value chain, based on insights from the case examples, Børnehuset Svanen and Hostrups Have?

Main conclusions

- When stakeholders are motivated and relevant technologies exist, circular ambitions often remain niche, held back by structural barriers, fragmented collaboration, and unclear responsibilities.
- The current stakeholder roles are shaped by conventional project structures, limiting early coordination between different professional groups.
- Political will remains inconsistent, particularly at the municipal level, which weakens the implementation of circular ambitions and reduces the pressure for long-term structural change.
- Regulatory frameworks set a direction for circularity, but their effect is limited by economic constraints that reduce the feasibility of alternative solutions and result in insufficient incentives.
- Transformative R-strategies like Refuse and Reuse remain rare, as they demand new collaboration, coordination, and shared responsibility across the value chain.

Conclusion

The findings underscore that circular construction is not merely a technical challenge, but a socio-political transformation shaped by political will, institutional structures, economic logic, and collaboration across the value chain. Although there is a growing awareness and willingness to engage in circular practices, implementation remains constrained by structural barriers and fragmented collaboration. As a result, circular strategies are still not embedded in standard practice, but often depend on motivated individuals and isolated initiatives.

Addressing these barriers requires action across multiple levels, from developers and project teams to policy makers and research institutions. The following recommendations outline the central steps to support a more comprehensive and integrated transition to circular construction.

Recommendations

For project teams in the construction process

- Integrate circular thinking from the early design phase to ensure feasibility of reuse, refurbishment, and material separation.
- Share knowledge and learnings from pilot projects systematically to reduce uncertainty in future initiatives.
- Form partnerships that allow shared risk and responsibility across the value chain.
- Actively use procurement as a tool to promote innovative and circular solutions.

For policymakers and public authorities

- Simplify and harmonize regulation to reduce uncertainty for stakeholders working with reused materials.
- Introduce financial and procedural incentives that reward circular practices, including tax benefits, grants, or fast-track permits.
- Link regulation to enabling tools, as LCA, material passports, and centralized documentation systems.

For research and knowledge institutions

- Examine how municipal budgeting and procurement logic can better support circular strategies.
- Investigate logistical bottlenecks in reuse infrastructures and opportunities for regional coordination.
- Support circular action by linking regulation with enabling tools, clear procedures, and incentives that reduce uncertainty and strengthen stakeholder engagement in early project stages.

9.1 Implications and broader perspectives

While this thesis provides in-depth insight into stakeholder roles and circular strategies based on the cases of Børnehuset Svanen and Hostrups Have, it is important to acknowledge its limitations. The empirical basis rests primarily on two examples, limiting the findings' generalizability. Other types of projects, for example, private housing, infrastructure, or cross-border collaborations, could offer contrasting insights or highlight different challenges and enablers.

In addition, the findings are shaped by the perspectives of interviewees, primarily professionals involved in project planning and consulting. Voices from users, contractors, and political decision-makers are underrepresented, which can influence which challenges and potentials are most visible in the analysis. Including these perspectives in future research could reveal further dynamics, especially regarding implementation and lived experience.

Furthermore, while the focus has primarily been on collaboration dynamics and structural barriers, aspects such as user experience, aesthetic considerations, and design decisions have received limited attention. These elements warrant further investigation, particularly as circularity increasingly intersects with architecture, design culture, and everyday practices.

Moving forward, future research could explore the following:

- Comparative studies across project types and national contexts to identify scalable patterns and context specific challenges.
- How procurement frameworks can be redesigned to better support interdisciplinary collaboration and early material planning.
- How can practical facilities like material banks and reuse centers, along with supportive logistics, be a part of bridging the gap between niche initiatives and mainstream adoption?

The transformation of the construction sector will not occur through isolated innovations or symbolic reuse. It will require rethinking the value itself, not only what materials are worth but how roles, risks, and responsibilities are distributed across the chain. In this, circularity is not only a design ambition or a policy goal but a fundamentally different way of organizing the act of building.

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Appendix

10.1 Appendix 1

Summary of the interview with Morten Ibsen from NIRAS - 3. april 2025

Morten Ibsen from NIRAS acted as project manager for the demolition of Gladsaxe School, which provided the foundation for constructing Børnehuset Svanen. NIRAS' role was primarily to assess material reuse opportunities, focusing on chemical safety and the practical feasibility of dismantling materials for reuse.

(00:03:02) *We qualified what is realistic, what is not realistic, and what we should say if we were to assess the chemical quality? It was acceptable. That is, in relation to environmentally hazardous substances, and it is Swan-labeled.* He further highlighted that the favorable conditions of this project are rarely present in similar cases:

(00:05:02) *We had the space for it, we had the time for it. It often cannot be done in this way.* On the economic side, he pointed out that while material reuse is often possible, financial considerations limit what is practically feasible:

(00:04:41) *It can be done. It's just not everything that makes sense economically, and sometimes you misjudge things.* Ibsen stressed that demolition crews need special experience to dismantle materials carefully enough for reuse:

(00:08:16) *If you ask someone to remove floorboards, for example, they'll ruin everything. But those who've practiced it know how to do it.* He also noted that there is a lack of buyers interested in reused materials:

(00:29:19) *I don't think the problem lies with the demolition industry. The demolition industry really wants to do this, but there's simply a lack of buyers.* Finally, Ibsen pointed out the importance of collaboration and mutual commitment among stakeholders:

(00:21:09) *It probably requires that everyone wants it (. . .) because it is difficult to give a fixed price on such tasks, and you can easily end up spending a bit more time than calculated, which affects the project economy, and sometimes people become dissatisfied and start shifting tasks between each other.* The interview ended with reflections on how the success of such projects depends on project conditions and collaboration between stakeholders.

For the full interview transcript, see **In the attach appendix document**

10.2 Appendix 2

Interview summary with Rebekka Stender Ilsøe, LH Hockerup - 14. marts 2025

Rebekka Stender Ilsøe from LH Hockerup provided insights into the historical development of the demolition industry and how circular practices have evolved over time. She explained that although selective demolition

has long been a standard practice at LH Hockerup, the economic viability of reusing building materials was historically limited.

Rebekka Stender Ilsøe from LH Hockerup provided insights into the historical development of the demolition industry and how circular practices have evolved over time. She explained that although selective demolition has long been a standard practice at LH Hockerup, the economic viability of reusing building materials was historically limited.

(00:02:34) *Back then, when he did it, people laughed at it. They thought it was pathetic... Oh, can't you afford new materials? That's so sweet.* Despite their early efforts, financial incentives were lacking, and LH Hockerup had to close its reuse facility, Clara Mølle, in 2014. According to Rebekka, only recently have public and private clients begun seriously requesting resource mapping and sustainable solutions.

(00:04:45) *Selective demolition is something we've been doing regularly since 2012. [...] That's something we've always done.* With the upcoming legislation taking effect in June 2025, she is optimistic that developers will take more responsibility for considering the reuse potential of materials before demolition:

(00:09:33) *I think it's great that it's now the responsibility of the developer, because essentially they need to start opening their eyes.* However, she highlights several practical challenges, such as a lack of storage space for salvaged materials and insufficient market demand:

(00:22:26) *We simply don't have the space, so we try to sell as many things as possible through Klaravik, an auction platform.* She also points out that while the company tries to reuse as much as possible in its own building projects, pragmatic decisions are often necessary:

(00:39:45) *We don't aim for 100 percent. We try to reuse as much as possible and be pragmatic about it.* Finally, Rebekka emphasized the importance of cross-sector partnerships and her company's commitment to raising awareness of circular solutions, even on a small scale:

(00:50:34) *We want to raise awareness among festivals because they use a lot of materials... And even though what we do may be small, it creates ripples.*

The interview ended with reflections on ongoing initiatives at LH Hockerup and the company's continued focus on exploring opportunities for collaboration and material reuse.

For the full interview transcript, see **In the attach appendix document**

10.3 Appendix 3

Summary of the talk with Janne Hagemann head of the children's institution Swan in Gladsaxe - 30. april 2025

The purpose of the visit was to observe the institution in practice and gain insights into the functionality of the building. During the visit, the head of the institution, Janne, provided a guided tour, sharing both the architectural intentions behind the building design and her own experiences using the facilities in daily operations.

The building was intended to accommodate children with special needs, such as those using wheelchairs or with autism. According to Janne, this was the only user-related consideration that was effectively integrated during the planning and construction phases, while most decisions were made by the architects. For instance, curtains are not allowed in the shared room used by children with special challenges, as this does not align with the architects' design vision.

Although the building technically accommodates children with special needs, several functional aspects were not sufficiently addressed. For example, all door handles had to be replaced, and the room interiors

simplified, as children with autism require fewer visual stimuli and should not be able to move around freely opening doors.

The Swan-ecolabeled building has also inspired the management to make more sustainable everyday choices. Disposable products are avoided, and equipment and storage solutions are selected to match the building's aesthetic expression, such as using wicker baskets instead of colorful plastic containers.

Janne highlighted the building's acoustics and overall spatial experience as particularly positive elements. Sound insulation and dampening materials have been carefully incorporated into wall coverings and larger furniture, significantly improving daily life in the institution.

The outdoor areas are spacious, but some planting areas, like the strawberry beds, are fenced off to prevent children from accessing them. However, Janne was not aware of the specific reasoning behind this extensive fencing.

Lastly, she mentioned practical challenges that were not sufficiently considered during planning, including the refrigerator being too small for the staff's lunchboxes and the lack of adequate storage space in the wardrobes for personal clothing, which is necessary due to changing weather conditions.

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10.4 Appendix 4

Interview summary with Lone Lindgård Laursen, Head of Sustainability, Ikano Home - 4. marts 2025

In the interview, Lone Lindgård Laursen, Head of Sustainability at Ikano Bolig, reflects on the company's experiences with integrating circular economy principles in the renovation project of the Old Town Hall in Høje Taastrup. While she emphasizes strong organizational support—*"They are quite engaged and ambitious on the sustainability agenda, which makes my job significantly easier because I basically have a mandate to initiate some things."*—she also highlights the major regulatory and economic challenges encountered in practice.

Choosing renovation over demolition triggered the need for a new local plan, causing costly delays: *"Because we went from demolition and new construction to transformation, it required a new local development plan, so the entire project was delayed by 1.5 years, which almost speaks for itself – it's a huge expense."*

She describes the heavy reliance on advisors and the complexity of opening up circular opportunities: *"I can just see that for us, it's extremely expensive and time-consuming. It's very advisor-heavy to open this up."* Additionally, building code requirements made it necessary to meet the same standards as new constructions, leading to expensive technical solutions: *"Something that has stood since the eighties suddenly can't bear the snow anymore."*

Despite these obstacles, the company chose to continue the project for strategic, environmental, and branding reasons: *"It's about doing the right thing, simply put. And we know that by not demolishing the building, we're already doing the most right thing."*

Finally, she expresses hope that the project will also showcase the aesthetic and market potential of circular solutions: *"I'm kind of hoping we can create some really cool 'town hall apartments' with eighties reuse. It won't be all of them, but maybe some of them."*

For the full interview transcript, see **In the attach appendix document**

10.5 Appendix 5

Interview summary with Martha Katrine Sørensen, Technological Institute - 11. april 2025

Martha Katrine Sørensen, Deputy Head at the Center for Sustainable Construction at the Technological Institute, primarily acts as an independent expert stakeholder in the building industry. She emphasizes their role as a knowledge facilitator: "Our role is really to be an impartial partner for the construction sector, facilitating knowledge and ensuring it reaches the industry."

Despite increasing interest in circular economy, Martha points out that it remains at a pilot project level: "It's still very much at pilot level; it takes time before it becomes real business." She also highlights the challenges with CE marking for reused materials: "You can't just have good intentions and make a single project with reused materials; you need volume and a continuous flow."

Martha underlines that the biggest impact comes from reducing consumption: "The first and most important agenda is reduction. We will never succeed unless we start using less." She further stresses that legislative support is essential to overcome economic barriers: "If there is demand from the client side, and if legislation supports it, we'll solve the technical challenges."

Finally, Martha notes that the market will regulate itself if the demand increases: "If the demand is there, the market will regulate itself." This underlines the importance of both political and market-driven efforts to accelerate circular practices.

For the full interview transcript, see **In the attach appendix document**

10.6 Appendix 6

Interview with Jan Larsen from Guldborgsund Municipality - 9. april 2025

Jan Ingemann Larsen from Guldborgsund Municipality's building permit department primarily plays an administrative role, ensuring compliance with building regulations rather than directly engaging with sustainability efforts. He explains that sustainability is currently not a significant focus in their department and that *"only 10% of commercial cases are selected for control"*

Although there is an interest in sustainable initiatives, financial considerations remain the primary driver: *"economy is still the biggest factor"* (Appendix 10.6). This is also evident in political discussions within the city council, where Larsen notes *"there is sometimes disagreement about whether we should build green and sustainable or achieve the most square meters"* From the municipality's perspective, sustainable transformation requires stronger legislation to become a priority. Jan emphasizes that without regulation, financial incentives will continue to dominate decisions, and large-scale change is unlikely to happen.

For the full interview transcript, see **In the attach appendix document**

10.7 Appendix 7

Interview summary with Anke Oberender, Technological Institute - 25. april 2025

Anke Oberender is a sustainability consultant at the Danish Technological Institute and can be understood as an expectant stakeholder within the salience model—specifically, one with legitimacy and urgency, though limited formal power. Her role focuses on enabling the construction sector's transition toward circular practices by building capacity and sharing knowledge between actors. As she describes one of her main

contributions: *"It's about telling the industry what's possible, because others have succeeded with something, so in that way, we can inspire and support the transition in the sector."*

Using best practice dissemination as a tool to inspire and support broader transformation, Anke Oberender and her colleagues work actively with documentation and testing of reused materials. The Danish Technological Institute has been directly involved in projects such as *Børnehuset Svanen*, where reused materials—including bricks—were tested for quality and suitability and actively incorporated into the final building, as seen at image 6.7.

This type of documentation plays a critical role in building trust around circular solutions and reducing uncertainty among market actors. It positions Anke Oberender as a facilitator of change, albeit one working from the margins of the existing socio-technical regime.

She also reflects critically on the sector's slow progress and the recurring barriers faced by actors trying to implement circular practices. As she explains, there is a widespread sense of collective frustration: *"There is a frustration because we have worked on this for so many years and have not come further. Or others say, it worked on this project, why did it not it work for us? Why is it so difficult??"*

Anke Oberender highlights the importance of pioneering by both public and private actors, pointing to the case of Gladsaxe Municipality: *"They have really been someone who wants this... I think both from the client and the contractor, all those involved... they are kind of pioneers in a way."* She emphasizes that such willingness to experiment cannot be expected from everyone, as it requires experience and a strong commitment from the client. Without sufficient flexibility in project timelines and an openness to alternative solutions, she notes, *"If it is too tight, then you don't embark on new things."*

While the introduction of climate requirements and selective demolition regulations is seen as a step in the right direction, Anke Oberender acknowledges that these measures alone are not enough: *"It's a step in the right direction. Not because it's the solution, but it definitely supports that more can be done."* She further reflects on the potential of financial incentives, such as allowing reused materials to count as zero in CO_2 calculations: *"It's not really zero because we have transport and handling, but it's an incentive—a carrot to do it."*

Finally, Anke Oberender underlines the Danish Technological Institute's continued role in supporting this transition through research, knowledge dissemination, and participation in EU development projects: *"We have to keep pushing this. Not just us—everyone has to become wiser and better at this."*

For the full interview transcript, see **In the attach appendix document**

10.8 Appendix 8

Summary of written response from Johan Elsass Nørby, Regional Manager, Heimstaden - 4. april 2025

The communication with Johan Elsass Nørby took place through a short initial phone call and a subsequent written exchange, where he provided answers to a series of prepared questions. In the phone call, Johan expressed confidence that small-scale circular initiatives within larger renovation or construction projects are likely the most effective path forward for advancing the circular economy in the building sector.

In his written responses, Johan explained that the idea to recycle window glass into glass wool was facilitated by a collaboration between the contractor on the project and Heimstaden, although the specific technical expertise for implementing this solution lies with the insulation producer.

When asked about the logistical and technical requirements for integrating the material into Saint-Gobain's production, Johan referred to the manufacturer directly, highlighting their detailed documentation available

online at (Saint-Gobain Isover, 2025).

Regarding documentation and classification requirements, Johan clarified that these responsibilities are distributed across project stakeholders:

- The designers hold the responsibility for setting the correct performance requirements.
- The suppliers are responsible for meeting product delivery standards.
- The contractors ensure correct execution and installation on site.

Finally, Johan pointed out that the main barriers to scaling such solutions lie in:

1. The quality requirements for reused building materials.
2. The quality and regulatory compliance of the final product, which typically requires documentation to meet building regulations and standards.

He also noted that it is usually the larger material suppliers who have the capacity to provide the necessary documentation and ensure product compliance with these regulations.

For the full interview transcript, see **In the attach appendix document**

10.9 Appendix 9

Summary of written response from Jan René Rasmussen, Head of Sustainability and Team Leader at Gladsaxe Municipality - 8. April 2025

Gladsaxe Municipality took an active role in facilitating circular practices in the kindergarten project on Tobaksvejen. Recognizing the project as a first-mover initiative, the municipality selected advisors with relevant experience and entered into a direct agreement with Lendager Group. As Jan René Rasmussen explains, "*We chose to investigate the market for advisors who could provide the desired consultancy – and the choice fell on Lendager Group.*".

The project took advantage of the available site conditions by retaining demolition materials onsite. "*We were in the unique situation that it was a closed down school with sports areas (a football field) nearby, which gave us the opportunity to keep the materials on site (...). This meant we avoided unnecessary transport.*" Materials such as crushed concrete and cleaned bricks were processed directly at the site to further reduce transport-related emissions.

Although the municipality handled the project internally, it did not experience preferential treatment in terms of regulatory processes. "*There is NO preferential treatment in the processing of the municipality's own construction cases compared to others*," but it was seen as beneficial "*to have the planning authority, environmental authority, and building case department close by to maintain good dialogue*".

Challenges arose when combining reuse ambitions with official certification requirements, particularly related to the Nordic Swan Ecolabel. "*This, combined with reuse and recycling, was a challenge for Miljømærkning Danmark; but we also met great willingness to find solutions.*"

Jan René Rasmussen notes that selective demolition and material reuse have since become a standard part of the municipality's construction projects, and that "*this mindset has become part of our DNA*". The municipality also highlights a political willingness and financial capacity to pursue such initiatives: "*A financially 'well-padded' municipality like Gladsaxe also has an obligation to lead the way and show the path forward.*"

For the full interview transcript, see **In the attach appendix document**

10.10 Appendix 10

Summary of Interview with Peter Hedegaard, Saint-Gobain Denmark - 11. April 2025

Peter Hedegaard from Saint-Gobain Denmark (Isover) positions the company as a decisive actor in advancing circular economy practices within the construction industry. He emphasizes that the company's engagement is driven by both strategic necessity and a growing sense of environmental responsibility: *"What has really become clear to the company are two things: resources are becoming scarcer, and we want to stay relevant while continuing to grow"*. This illustrates a clear business urgency aligned with global sustainability trends.

At the operational level, Hedegaard highlights that implementing circular solutions is highly dependent on overcoming practical, everyday barriers on construction sites. In the case of Hostrups Have, Isover took the initiative to introduce the *Glass to Wool* concept after learning that the contractor Byens Tag & Facade, with whom they had previous experience, had secured the main contract. This early involvement enabled the circular solution to be proposed already during the planning phase, after which it was implemented in collaboration with Heimstaden as the developer. According to Hedegaard, Heimstaden found it a natural decision to participate once the proposal was presented, underlining the attractiveness of circular models based on proven materials with established functionality and safety (Heimstaden, 2024).

Despite such early-stage initiatives, significant challenges remain during implementation. One of the most pressing issues, according to Hedegaard, is not only the availability of storage space but the complexity of managing the entire logistics chain: *"It's a very practical issue. It can be difficult to get things picked up exactly when you need the space cleared. (...) It might be the last 10 pallets sitting on one or two parking spots, and they're supposed to be picked up tomorrow, but then we can't come until next Thursday to collect them"*. These challenges illustrate how circular initiatives often rely on precise timing and efficient space management, which can be particularly difficult in dense urban environments.

Although Saint-Gobain operates further down the value chain, Hedegaard emphasizes the importance of shared responsibility among stakeholders, particularly when developers demonstrate a genuine commitment: *"Out of respect for Hostrups Have (...) we want to tell their story, because they actually wanted to do this"*.

At a structural level, Hedegaard also points to the economic barriers to circularity. Contrary to common assumptions, the value of circular materials does not reside in the materials themselves but emerges from the labor, logistics, and coordination required to make reuse possible: *"That's actually the whole misunderstanding about circular economy. Everyone focuses on the materials having high value, but they just don't"*.

In this context, framing circular initiatives economically becomes essential for gaining stakeholder support. As Hedegaard explains, it is often about clearly presenting the options to decision-makers: *"We need to help each other change behavior (...) present it to the developer like: for a bit more money, this can be done the right way, what would you rather do?"*.

For the full interview transcript, see **In the attach appendix document**