Beyond blueprints: The crucial role of stakeholder engagement in sustaining R-strategies of circular economy in housing projects

A study of stakeholder engagement in the conceptualisation phase of a project life cycle for lasting R-strategies in housing projects.

Bas de Boer | 4589408

Prof.dr. P.W. Chan
Dr.ing. G.A. van Bortel
Drs. A. Mulder

Het Parool

Woningmarkt op slot voor middeninkomens

Woonwethouder heeft hoge ambities

Meer betaalbare ningen nodig

Jongerenafdelingen van politieke partijen luiden de noodklok

'Er moet meer gebouwd worden'

Van onze parlementaire redactie

DEN HAAG • Jongerenafdelingen van politieke partijen luiden de noodklok over woningnood. Ze eisen dat het

de financiële situatie van de aanvrager, en meer naar diens perspectief. „Kijk bijvoorbeeld naar iemands opleiding." Op die manier moet een aanvrager makkelijker aan een groter bedrag kunnen komen.

Veel nieuwbouw, zoals hier op het Amsterdamse Lijburg, is volgens de jongerenafdelingen de oplossing voor woningnood. FOTO AMAURY MILLER

FORSE STREEP DOOR HUURWONINGEN

door Gert van Harskamp

AMSTERDAM • Er worden de komend duizenden gebouwd dan gepla

ten op de instabiele van hun woning. Woningcorporaties willen jaarlijks minstens 34.000 woningen bouwen en in 2021 moeten alle

Woningnood is nergens zo groot als in deze stad

75.000 nieuwe huizen nodig

De komende vijf jaar moeten er 75.000 woningen worden gebouwd om de woningnood in Oost-Nederland op te lossen. Vooral in Nijmegen, Arnhem en de heerst een nijpend tekort an huizen.

Nu al verhuizen er meer mensen vanuit Utrecht naar Ede dan omgekeerd. De vele jongeren die voor studie naar de Randstad vertrekken laten geen woning achter.

De verhuisstroom uit de Randstad zorgt voor een snelle verstedelijking van Arnhem en Nijmegen, Stientje van Veldhoven van Wonen en Milieu en Kamerleden aangeboden.

Het kabinet heeft 1 miljard euro uitgetrokken voor woningbouw in Amsterdam, Rotterdam, Den Haag, Eindhoven en Groningen. Nu eist ook Oost-Nederland daarvan een

7122

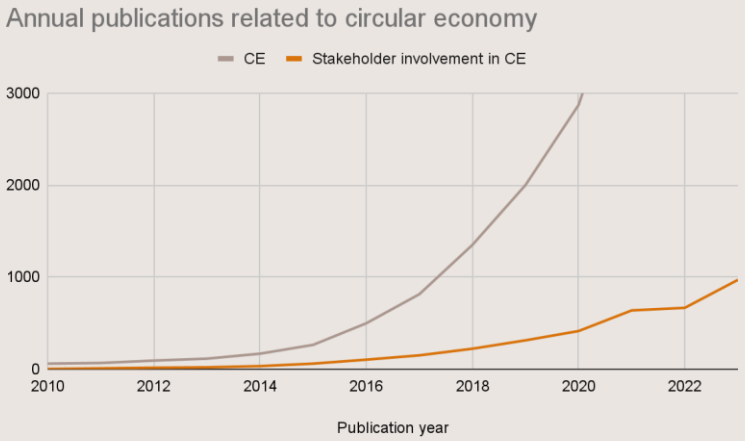
■ Woningtekort in Nijmegen

ren kan eigenlijk niet meer.

Meer dan 40 procent van de tuurgebieden ligt in Gelderland Overijssel. In het Woonakk Oost willen de provincies sa met het rijk zoeken naar crea oplossingen om toch te ku bouwen.

Gedacht wordt aan flexwor

Addressing the gap in literature



Publications on Circular economy

Ratio in 2023

7.5 : 1

Papers on stakeholder involvement in CE in 2023

970

Research questions

Main research question:

What variables influence stakeholder engagement in new circular housing projects, and how can R-strategies be sustained during the conceptualisation phase?

Sub-question one :

Which stakeholders from various backgrounds actively engage and contribute to the design conceptualisation phase of a circular housing project?

Sub-question two :

What are the fundamental motivations and objectives that encourage the active involvement and contributions of various stakeholders throughout the conceptualisation phase of a circular housing project?

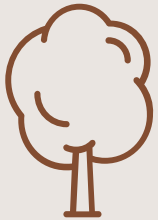
Sub-question three :

What are the key challenges and opportunities stakeholders encounter in implementing the R-ladder principles, in housing projects?

Sustainability vs. Circularity: what's the difference?

Sustainability:

- Minimize harm to the environment
- Use resources more efficiently
- Lower emissions and reduce waste



VS.

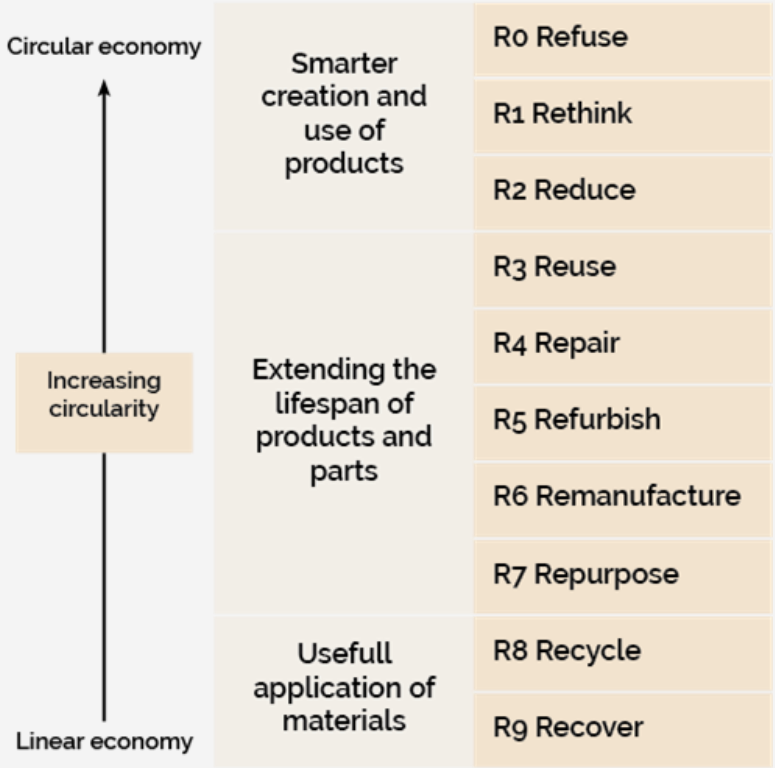
Circularity:

- Eliminate waste from the start
- Design to be reuse, repair and recycle
- Keep materials in use for as long as possible

Take, make & dispose

Closing the loop

The R-Ladder framework for circularity



In my research, these strategies guide the development of circular housing projects, ensuring materials are reused and waste is minimized.

A key question for circularity

How do we make circular strategies work in practice?

The four C's

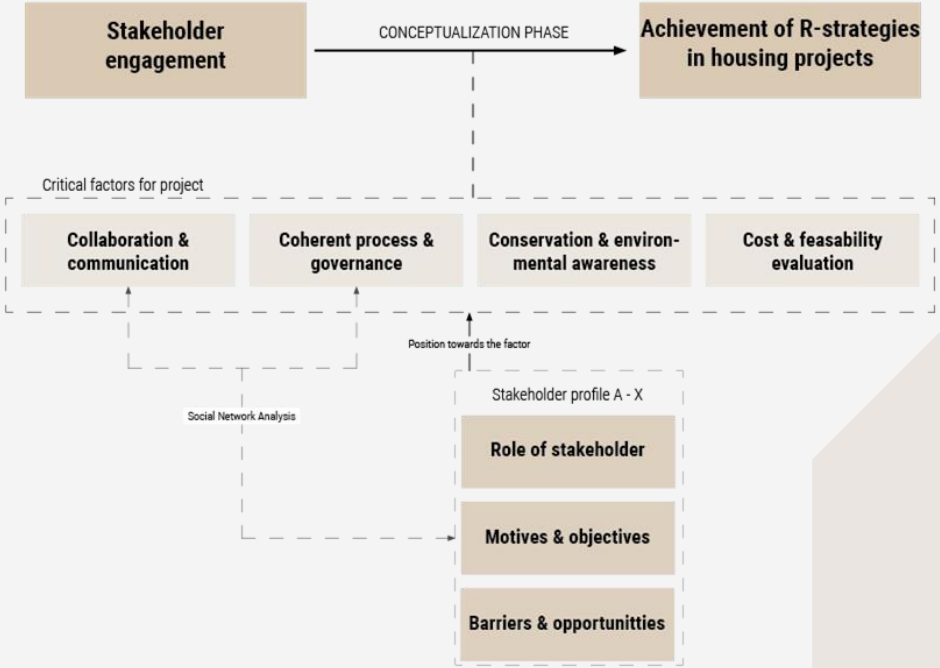
01 Collaboration & communication

02 Coherent process & governance

03 Conservation & environmental awareness

04 Cost & feasibility evaluation

Conceptual framework



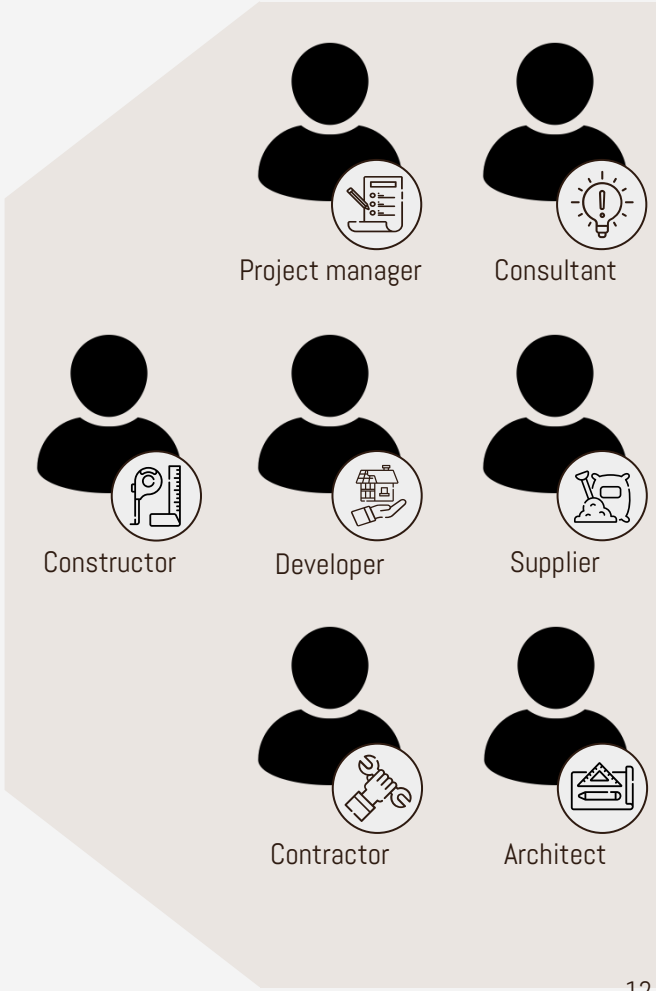
"Hypothesis: Effective stakeholder engagement positively correlates with successful circular strategies."

Case Study

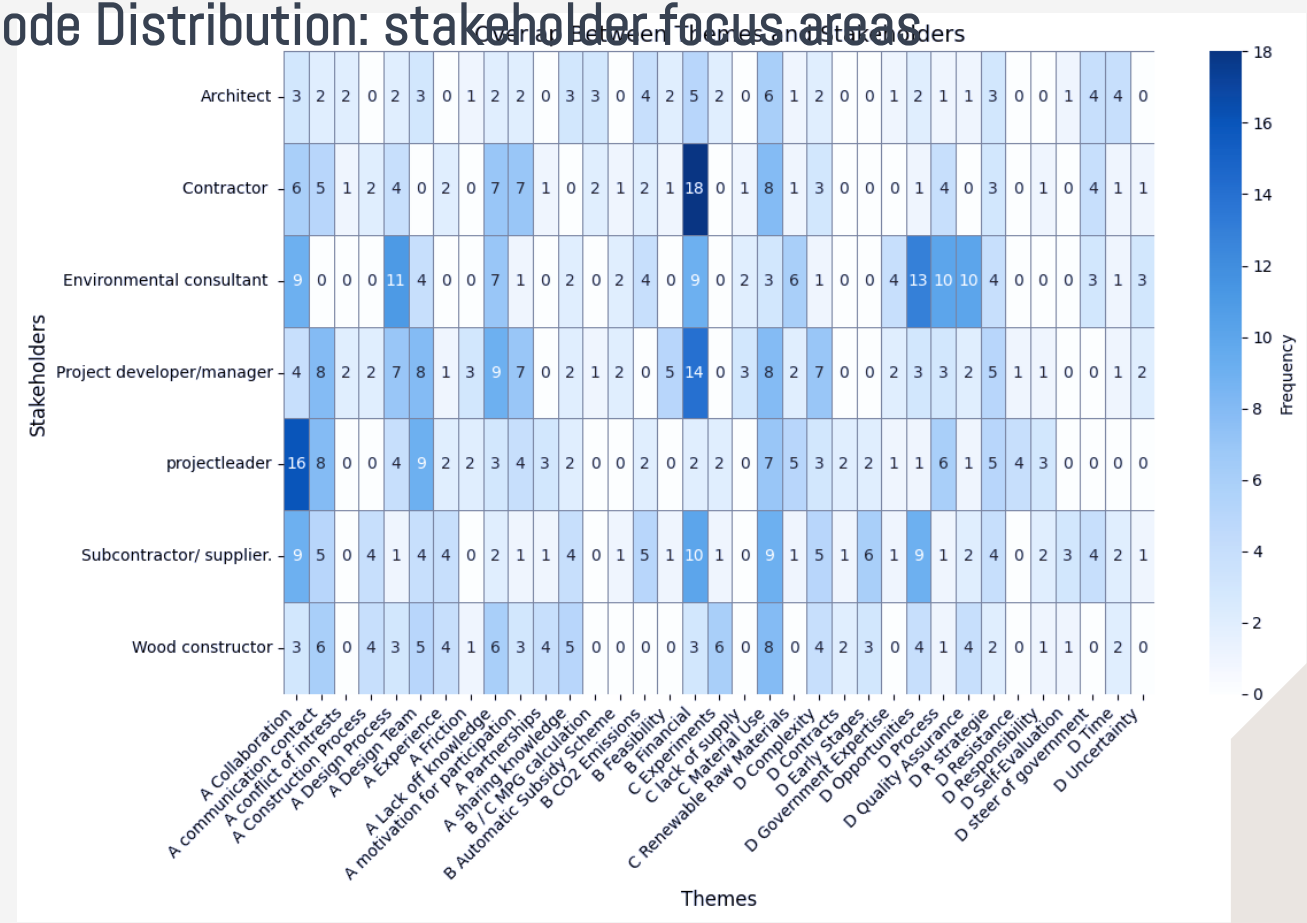
Project "Matchbox" Strijp-S

From raw data to key concepts

Raw Data	1ste order concepts	Aggregate dimension
"design team was formed with parties who have experience in timber construction, so to speak."	Collaboration	Collaboration & Communication
"you first have to involve the advisor who has experience in it. So not a consultant that's been around for 100 years. And not an advisor anymore they think sustainability is nonsense."	Experience	
"But there is a fair amount of emailing back and forth. But it also becomes very structural. In the design team. In the preparation phase just like that."	Communication of contact	
"we think in a lot of people the intrinsic motivation to do something with it. And the realization of, uh, if we don't do anything, it stops."	Motivation to participation	
"You do see that at this stage there are still a lot of parties that are not so familiar with it. And who also raise questions in all kinds of areas."	Lack off knowledge	
"Ultimately, those discussions are always between the contractor. And architect and client. That's where the main discussions end up. Architect wants something more in terms of architecture. Or in terms of perception."	Complexity	
"From the government a regulation or look in Amsterdam for example you already have that 20% of the construction should be sustainable. Those kinds of rules that help, of course, also force parties that do not care to think more sustainable."	Steer of government	Coherent process & Governance
"But it is a starting point of what we say, at the beginning of the project is established of, What is the target audience, what is the cost, are we going to build up or down."	Process	
"We give advice. If that does not work, then we put it to the project management and then we can actually say that, we say, we do not give a guarantee on it. "	Responsibility	
"To see how you can shape that whole circularity thing. In the beginning, we did that in the form of experiments. So for example, we built a workshop in Woens Dorp-West, 100% with second-hand materials. We also built a set-up room, entirely with second-hand materials."	Material use & experiments	Conservation & Environmental Awareness
"Well you hope that by applying it more that there is more knowledge. And that it will thus become simpler and therefore cheaper. Or that it will be scaled up. That new products come onto the market. And that it then becomes competitive again with that."	Lack of supply	
"Also, circular construction. Less pollution. Less disturbance. We spread those kinds of terms in the world as well. But we also see that there are many ambassadors in the Netherlands now. Who are working on that. And also, the law is simply going to come. So that you are less burdensome on the environment. And less CO2. That will also become law soon."	CO2 emission	



Code Distribution: stakeholder focus areas



Key quotes from stakeholders

"Sustainable construction can be done, but so far sustainability is often also more expensive. And underneath it you find the obstacles of, say, many parties that want to, but there is no budget." Contractor

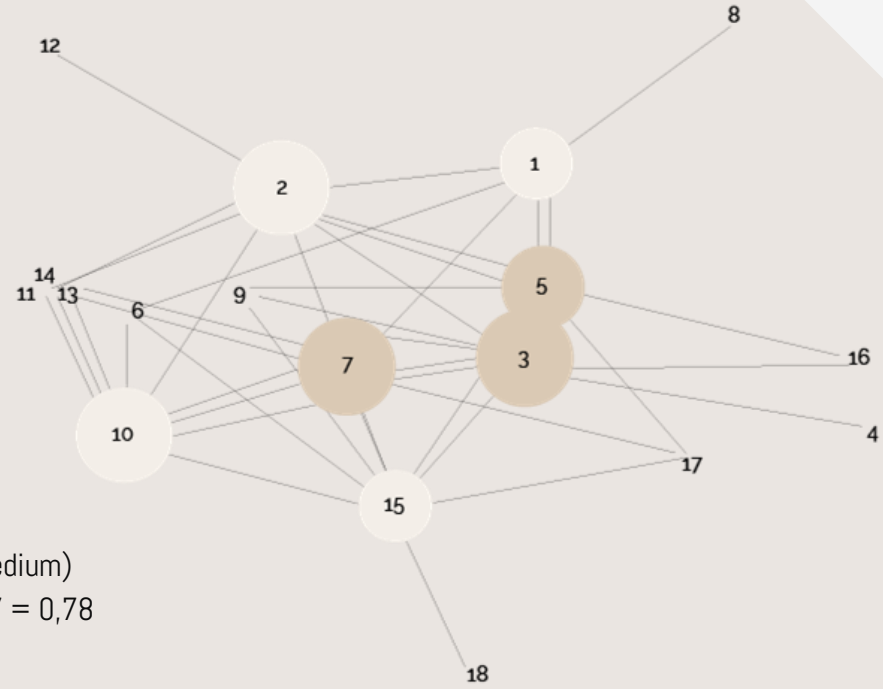
"During the time of crisis, we also entered into that long-term collaboration with a lot of parties. That they know if we join forces with Trudo then we will just have work for the next 10 years." Project manager

Findings of research

Through matches & mismatches and a SNA

Social Network Analysis

The Social Network Analysis relies on two essential metrics: density and centrality. Density measures how closely stakeholders are linked in the network, while centrality highlights the significance and power of certain stakeholders within the network.



- Density of 16% (medium)
- Centrality node ID 7 = 0,78

1 Project developer
2 Environmental consultant
3 Contractor
4 Home owners
5 Architect
6 Installation specialist
7 Constructor
8 Landschap architect
9 Client
10 Project leader
11 Municipality
12 Cost experts
13 Consultants
14 Engineers
15 Suppliers
16 Colleagues
17 University
18 Concrete supplier
19 Fire department

Collaboration and Communication

- **Conceptualization Collaboration:** The motivation to participate in circular projects is crucial at the start of a project.
- **Early Involvement & Communication:** Active participation from the start of a project helps people make smart decisions and align their strategies.
- **Knowledge Exchange for Sustainability:** Collaboration is what makes circular building practices more innovative and efficient.This shows how important it is to have standardised information frameworks and knowledge resources that are centralised.

Coherent process and Governance

- **Circular Housing Projects Overview:** Innovative approaches to environmentally friendly building are being used in circular housing projects.
- **Stakeholder Engagement and Project Management:** Trudo's strategy is based on paying close attention to parameters and involving stakeholders, which encourages teamwork and quality control.
- **R Strategies and Government Role:** Support from the government in R-strategies is very important, but regulatory uncertainty and miscommunication can make things hard.

Collaboration and Communication

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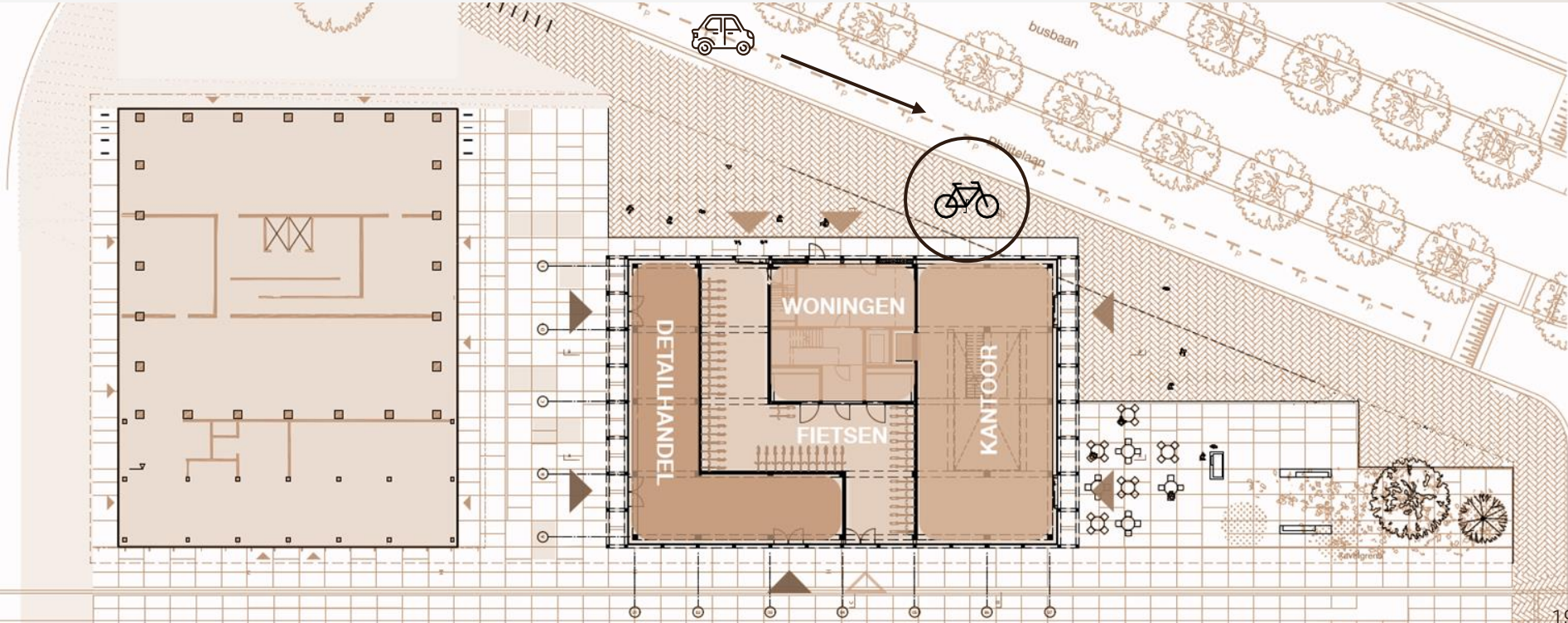
Coherent process and Governance

- **Circular Housing Projects Overview:** Innovative approaches to environmentally friendly building are being used in circular housing projects.
- **Stakeholder Engagement and Project Management:** Quality control ensuring that agreements are met and that standards are upheld throughout the process.
- **R Strategies and Government Role:** Backing from government agencies makes it much easier to integrate circular practices, but regulatory uncertainty and miscommunication can make things hard.

Tension in Communication

- Collision Protection
- Municipal Property Issue
- Inconsistent phone and email communication



Conservation and Environmental Awareness

- **CO2 Emission and Sustainability:** Finding a balance between environmental goals and budgetary constraints is hard. Subsidies become important factors that encourage eco-friendly actions.
- **Material Use and circularity:** The "Matchbox" project shows a dedication to circularity by selecting materials with care and trying new things R0, R3 and R9. But problems arise when materials are scarce and there are disagreements over guarantees.
- **Financial Considerations and Material Selection:** Material choices are affected by the costs involved. And the supply chain of these materials can be the cause of a problem.

Cost and feasibility evaluation

- **Financial Landscape:** Stakeholders struggle to deal with economic limitations and R-strategies while also keeping costs low.
- **Feasibility Challenges:** Decisions are based on money, which affects the viability and sustainability of a project. Finding a good balance between requires careful negotiation and smart decision-making.
- **Role of Subsidies:** Subsidies are a key part of making projects more likely to succeed and last, as they lower costs and encourage people to use environmentally friendly methods.

Key quote from stakeholder

"What's more sustainable than wood? Secondhand wood. We explored using reclaimed timber from old mooring posts to create stunning facades. But when I needed 5600 square meters of planks, no supplier could guarantee that quantity at the time required. Plus, reclaimed wood isn't tested for fire safety standards, meaning no guarantees, no permits, and the project stops there." Project developer / manager

Conservation and Environmental Awareness

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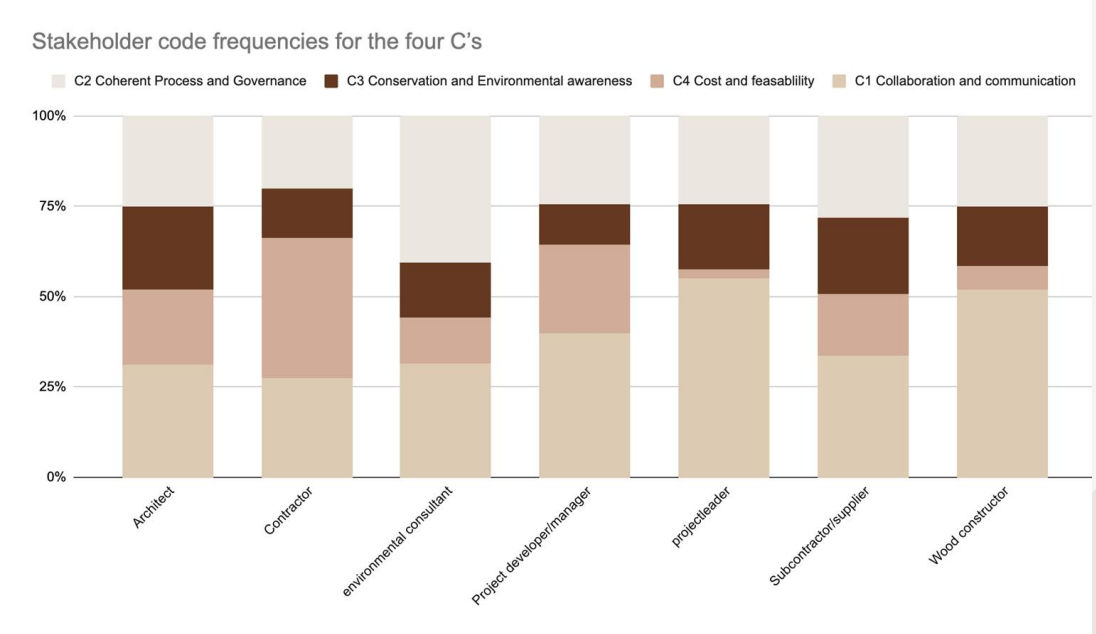
Stakeholder priorities across the four C's

Mapping out stakeholders relations towards the four C's



- Gives insight into priorities of stakeholders
- C3 is mentioned by all stakeholders due to the common goal of the project.

Synergy of four C's with the SNA

	C1	C2	C3	C4	Centrality score
Architect	31,3	25	22,9	20,8	0,66
Contractor	27,5	20	13,8	38,7	0,72
environmental consultant	31,4	40,7	15,1	12,8	0,66
Project developer/manager	40	24,4	11,1	24,5	0,5
projectleader	55,1	24,4	17,9	2,6	0,5
Subcontractor/supplier	33,8	28,2	21,1	16,9	0,6
Wood constructor	52,1	25	16,7	6,2	0,77

- The wood constructor has a higher centrality than the contractor.
- Collaborating with stakeholders with higher centrality (e.g., wood constructor) can increase project manager's influence.
- Environmental consultant prioritizes C1 & C2.

Project manager

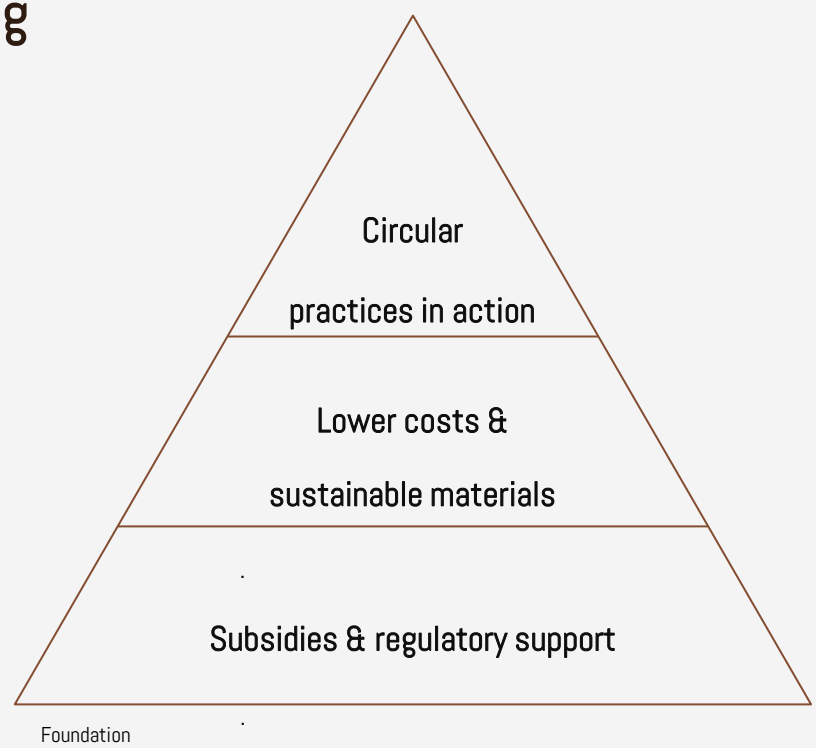
Constructor

How subsidies support circular building

Coherent process & governance

Conservation & environmental awareness

Cost & feasibility evaluation



"New materials can be expensive and lack regulatory support"

Quotes

Question: In what ways do you envision environmental consultants and other emerging stakeholders contributing to overcoming challenges associated with implementing the R-ladder principles in circular housing projects?

"More experts need to be trained, not just in consultancy but within government as well at municipal and provincial levels. It's essential that project requests include the requirement for government involvement in overseeing whether what's outlined in permits is actually implemented." Environmental consultant

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Key contradictions and contributions in circular housing

Literature findings	Study findings
Circular projects use linear decision-making processes	Circular projects face ongoing challenges in reaching agreements with all stakeholders therefore flexible decision-making is needed.
Internal governance is key (Z. Yang & Yang, 2009)	Nuance, because inconsistent access to these subsidies can lead to significant delays and cost issues. A culture shift is needed.
Contractors play a central role (Gerding et al., 2021)	Wood constructor plays a more central role than contractors.

Future research directions in circular housing

Social network analysis

Explore how stakeholder centrality shifts with different materials to reveal new dynamics in circular housing

Supply chain dynamics

Identify supply chain bottlenecks and explore innovative models to ensure steady, affordable bio-based materials

The future of R-strategies in circular housing projects

What variables influence stakeholder engagement in new circular housing projects, and how can R-strategies be sustained during the conceptualisation phase?

C1  Align strategies early

C2  Overcome regulatory gaps and do assessments

C3  Promote sustainable choices

C4  Balance financial and environmental goals

Together, these factors create a foundation for circular housing that supports sustainable urbanization.

Recommendation report

- Improving density
- “The wheel of circular engagement”


Any
questions?

Research framework

Literature Review

- Rigorous data collection and analysis for quantitative insights.

Semi-In-depth Interviews

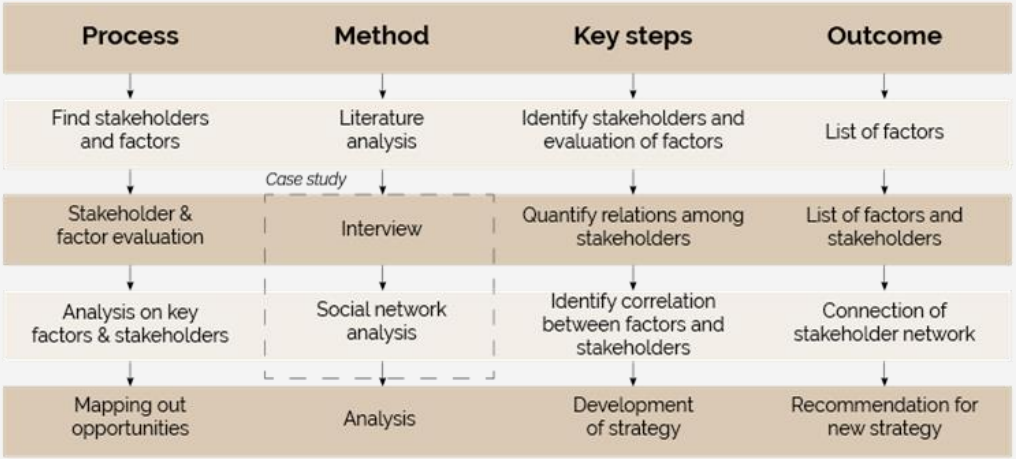
- Gather qualitative insights to complement quantitative data.

Social Network Analysis (SNA)

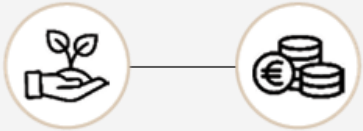
- Explore stakeholder interactions and network dynamics.

Integration of Findings

- Combine qualitative insights and SNA results.



Synergy within the four C's

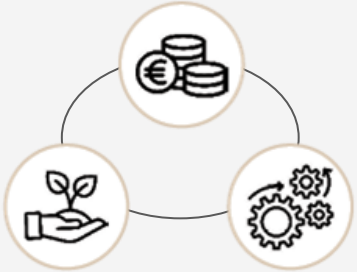


C3 and C4

Reducing CO2 emissions through circular construction is very important, but using eco-friendly materials is often not possible because of cost issues.

C3 and C2

Good governance and clear regulatory processes are essential for integrating circularity into construction projects, as regulatory gaps can lead to delays.



C2, C3 and C4

Subsidies play a key role in bridging the gap between circularity and viability by lowering costs and supporting eco-friendly materials. This is especially important when regulatory gaps for new materials hinder the adoption of circular practices, resulting in higher costs and project delays.

Interpretation and comparison of result

Collaboration & Communication

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Discovery of in-house feedback loops, highlighting the significance of feedback at the conclusion of a project.

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Coherent process & Governance

The difficulties that come with putting circular housing projects into action. Especially when it comes to regulatory frameworks and government support, which are very important for the project to succeed.

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Conservation & Environmental Awareness

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Surprisingly, stakeholders didn't know much about technologies and features that are good for the environment. This lack of understanding could be caused by not having enough market education.

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Cost & feasibility evaluation

Stakeholders rely on grants and subsidies, like the MIA subsidy, to keep project costs down and make the project more likely to succeed.

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Decision-making difference

Linear	flexible
Sequential Process: Decisions are made in a step-by-step, structured order.	**Iterative Process**: Decisions are revisited and adjusted as new information or challenges emerge.
Less Adaptability: Once a decision is made, the process continues forward without much change, even if new information or challenges arise.	**Higher Adaptability**: Stakeholders can pivot or revise strategies in response to changing circumstances, making it better suited for complex or uncertain environments like circular housing projects.
Predictability: It's more predictable and straightforward, often used in traditional project management where objectives and methods are well-defined from the start.	**Dynamic**: It is more responsive to unexpected issues, such as regulatory changes or supply chain disruptions.

Limitation

Biasism

The Snowball Sampling Method (SSM) relies on existing contacts, it may introduce Sampling Bias. This could lead to a sample that isn't representative, with some stakeholders being over- or under-represented.

Data collection

The study used a wide range of methods to gather data, such as literature reviews, case studies, and qualitative interviews. Even though it's useful, it might leave gaps in our understanding of how things work at all stages of a project's life cycle, which could affect how strong and detailed the findings are.

Methodology

Social Network Analysis (SNA) may oversimplify stakeholder interactions and motivations. Limited access to stakeholders may have restricted the study's scope, overlooking critical aspects of circular housing engagement. Using a single case study ("Matchbox") limits generalizability, cautioning against broad application to other contexts.

Future directions

01

Supply chain dynamics for sustainable materials

Investigate availability, affordability, and quality of sustainable and bio-based construction materials.

02

Policy & regulatory frameworks

Compare and evaluate policy frameworks impact on circular practices and regulatory hurdles.

03

Financial mechanisms & subsidies

Study the influence of subsidy programs and financial mechanisms on advancing circular economy principles in construction.

04

SNA housing projects

Study how the SNA will change with different kind of building materials.

Research question one:

Which stakeholders from various backgrounds actively engage and contribute to the design conceptualisation phase of a circular housing project?

The constructor plays a central role in the design conceptualization phase of a circular housing project. Actively engaging with project developers, environmental consultants, architects, contractors, and the municipality. These stakeholders bring diverse expertise, supporting innovation and the application of R-ladder principles. Their engagement is essential for aligning R-strategies and addressing financial and regulatory challenges, thus fostering the success of circular housing initiatives.

Research question two:

What are the fundamental motivations and objectives that encourage the active involvement and contributions of various stakeholders throughout the conceptualization phase of a circular housing project?

Stakeholders in circular housing projects are driven by financial feasibility, sustainability imperatives, and regulatory compliance. They seek subsidies to offset high costs, align project goals with environmental objectives, and ensure adherence to evolving regulations. Community engagement, knowledge sharing, and continuous improvement further motivate stakeholders. This highlights the collaborative effort needed to successfully implement R-strategies in new housing projects.

Research question three:

What are the key challenges and opportunities stakeholders encounter in implementing the R-ladder principles, in housing projects?

Stakeholders face financial constraints, regulatory ambiguities, supply chain limitations, and technical complexities in circular housing projects, impacting costs, timelines and material supply. Despite these challenges, they find opportunities in innovation, collaboration, and community engagement, using circular and bio-based construction, second-hand materials, and local involvement to enhance social and environmental responsibility. Government support and policy alignment help overcome regulatory hurdles. While feedback loops and self-evaluation optimize results, driving transformative change towards a more circular future.

Main research question:

What are the variables that influence the engagement of stakeholders in new housing projects, and how can the use of R-strategies be maintained during the conceptualization phase of a project?

The engagement of stakeholders in new housing projects is influenced by collaboration, communication, cost and feasibility evaluation, conservation and environmental awareness, and coherent processes and governance. Successful implementation of R-strategies during the conceptualization phase requires developing collaborative partnerships, maintaining open communication, and involving diverse stakeholders in decision-making. Overcoming challenges such as regulatory ambiguities and limited government knowledge can be achieved through increased collaboration, innovation, and continuous improvement, ensuring the effective use of R-strategies and contributing to circular development goals.

Strategy report

01 | Introduction

This document provides methods and ideas for increasing stakeholder engagement in new housing projects. In order to effectively adopt R-strategies (Refuse, Rethink, Reuse, Repair, Remanufacture, Repurpose, Recycle, and Recover) throughout the conceptualization stage. The recommendations are based on a thorough investigation of stakeholder participation in circular housing projects and studies of the existing literature. Four themes were indentified as critical for developing stakeholder engagement and sustaining R-strategies as can be seen below.

Collaboration & Communication

Coherent process & Governance

Conservation & Environmental awareness

Cost & Feasibility evaluation

By tackling the issues related to these themes, this document presents ideas which can lead to a more circular and efficient approach to home building. This approach not only encourages environmental governance, but it also improves the financial viability and social impact of initiatives. The recommendations include feasible measures for incorporating important stakeholders, maximising subsidies, and increasing communication and collaboration throughout the project's conceptualization stage.

02 | Engaging diverse stakeholders

Stakeholders with diverse backgrounds, including constructors, project developers, environmental consultants, architects, contractors, and government entities, play a crucial role in the design conceptualization phase of circular housing projects. To enhance engagement and collaboration among these stakeholders, consider the following strategies:

Central role of the constructor:

- Use the constructor's central location as a hub to facilitate communication and collaboration.
- Encourage constructors to monitor the alignment of R strategies, financial considerations, and regulatory compliance throughout the project's lifecycle.

Foster collaboration and innovation:

- Create platforms for regular stakeholder meetings and workshops to share knowledge and innovative practices.
- Implement governance frameworks that promote transparency and accountability, ensuring all voices are heard and considered.

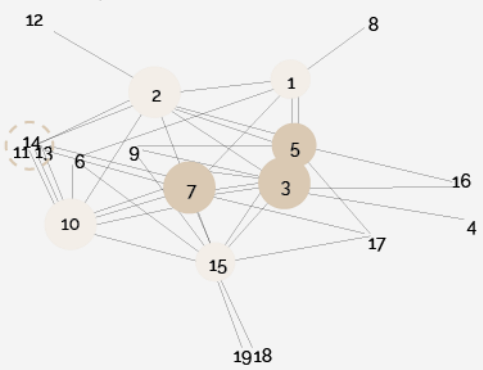
Community participation:

- Engage local communities in the project development process to gather diverse perspectives and foster a sense of ownership and responsibility.
- Develop community engagement initiatives that reflect stakeholders' commitment to social and environmental responsibility.

03 | Improving network connectivity

Insights from the social network analysis highlight opportunities for enhancing stakeholder connectivity and communication to improve project outcomes. Currently, the network shows a medium-density of around 16%. Key roles are played by contractors, architects, and constructors, who serve as central connectors. They facilitate effective communication and coordination, aligning project goals with sustainability objectives.

Project leaders, developers, and environmental consultants also play crucial roles, contributing to network cohesion and effectiveness. Their participation makes sure that environmental impact and environmental standards are taken into account in strategic decisions and encouraging new ideas throughout the whole project lifecycle. Another thing to note is the cluster's potential, as shown below around ID 11, 13, and 14.



ID	Stakeholder
1	Project developer
2	Environmental consultant
3	Contractor
4	Home owners
5	Architect
6	Instalation specialist
7	Constructor
8	Landscape architect
9	Client
10	Project leader
11	Municipality
12	Cost experts
13	Consultants
14	Engineers
15	Suppliers
15	Colleagues
17	University
18	Concrete supplier
19	Fire department

Increased involvement of the municipality:

- Involve the municipality from the start of the project to ensure their input and support throughout the project lifecycle.
- Enhance communication channels between the municipality and other stakeholders to facilitate timely decision-making and project approvals which is supported by the cluster above.

Enhanced collaboration with the fire department:

- Link the fire department with suppliers, constructors, and the municipality for earlier approval of materials.
- Establish connections between the fire department and the university to support the development of new materials. This collaboration will ensure that research efforts align with regulatory and safety standards, providing both innovation and assurance.

POTENTIAL OUTCOME

By implementing these improvements, the density of stakeholder connections will increase to 25%, a 9% improvement. Resulting in a better engagement within the network.

04 | Addressing financial feasibility

Financial constraints are a significant challenge in circular housing projects. To mitigate these challenges and enhance project feasibility, consider the following approaches:

Utilize subsidies effectively:

- Identify and leverage various subsidy programs, such as the Environmental Investment Deduction (MIA) subsidy, to offset high development and production costs.
- Educate stakeholders on available subsidies and how to apply for them effectively to ensure financial sustainability.

Feasibility assessments:

- Ensure that a feasibility assessment of the costs of circular materials is completed early in the project. This will ensure that at a later stage, stakeholders know if it is realistic.
- Balance stakeholder needs by integrating financial support mechanisms that align with sustainability imperatives.

05 | Overcoming regulatory and technical challenges

Regulatory ambiguities and technical complexities often pose hurdles to the successful implementation of R-strategies. To address these issues:

Seek regulatory clarity:

- Engage with government agencies to clarify regulatory requirements and ensure compliance.
- Advocate for supportive policies that promote sustainable construction practices and reduce regulatory barriers.

Enhance technical capabilities:

- Invest in research and development to explore new materials and construction techniques that align with R-ladder principles.
- Provide training and resources to stakeholders to improve their technical expertise and capacity to implement circular practices.

06 | Promoting continuous improvement and innovation

Implement feedback loops:

- Establish mechanisms for regular feedback and self-evaluation to identify areas for improvement and optimize project outcomes.
- Encourage stakeholders to share best practices and lessons learned to promote continuous learning.

Encourage adaptive decision-making:

- Develop adaptive decision-making frameworks that allow stakeholders to respond flexibly to emerging challenges and opportunities.
- Foster strategic partnerships that enable collaborative problem-solving and innovation.

06 | Timeline for stakeholder involvement

The timeline for the conceptualization stage of a project emphasizes early stakeholder involvement. This is needed to enhance the project outcomes and ensure the effective use of R-strategies. Early involvement of stakeholders is critical throughout the process, ensuring engagement and being in line with the project's goals. Consultants are recommended to be involved early in the concept design stage. These type of consultants include, environmental, financial, and technical consultants. This early commitment makes it possible to collaborate with the municipality to look into potential funding and ensure that project ideas comply to the rules.

Following the initial concept design, Stakeholders, like material suppliers and constructors, are intorduced in to make sure that the calculations and feasibility assessment are done correctly. The timeline aims to maintain stakeholder engagement throughout the project phases. Making sure that their ideas are always taken into account to make the project more feasible and long-lasting.

07 | The wheel of circular collaboration

The "wheel of circular collaboration" serves as a framework to guide and ensure the successful implementation of R-strategies in circular housing projects. This wheel consists of several key elements that are crucial for maintaining circular ambitions. Furthermore, fostering collaboration among stakeholders is also a product of the wheel. The following elements are essential components of the Wheel of Circular Collaboration.

Critical stakeholder selection | Begin by carefully selecting stakeholders whose motivations align with the project's vision for circular housing. Ensure their commitment to sustainability and circular principles.

Early stakeholder involvement | Involve relevant stakeholders early in the project to integrate circular principles from the outset. Assess the financial feasibility of circular options at this stage.

Proactive decision making | Make proactive decisions that support circular goals, ensuring alignment with sustainability objectives.

Supply chain | Evaluate the supply chain of materials, including the origin of materials and the availability of recycled materials to meet project demands.

Quality control | Implement a quality control document to maintain circular ambitions throughout the conceptualization and construction phases. Ensure decisions are followed through to implementation.

Sharing knowledge | Facilitate knowledge sharing among stakeholders, both within and between organizations. Foster a collaborative environment that promotes innovation and learning.

Feedback loops | Establish a feedback loop involving all stakeholders to review project outcomes. And discuss the potential lessons that can be learned from the project.

Data base | Document all the gathered information in a database to accumulate knowledge across circular housing projects. This can include various types of data, such as wooden details within the construction, but also what happened during critical stages of the project.

IMPLEMENTING THE WHEEL

Implementing the "Wheel of Circular Collaboration" makes sure that each project builds on the lessons learned and successes of the ones that came before it. Stakeholders can work together to improve sustainable practices by encouraging openness, cooperation, and early decision-making. And reach the goal of making the built environment more circular. This method not only reduces the need to come up with new solutions, but it also speeds up the adoption of circular housing practices, which makes the future more circular.

08 | Conclusion

Achieving the goals of circular housing projects requires a collaborative effort from all stakeholders. By leveraging the central role of constructors, improving network connectivity, utilizing subsidies effectively, addressing regulatory and technical challenges, and promoting continuous improvement and innovation, stakeholders can significantly enhance their engagement and ensure the successful implementation of R-strategies during the conceptualization phase.

These strategies not only pave the way for more sustainable and resilient housing projects but also contribute to the broader goals of environmental stewardship. Through collective efforts and strategic planning, stakeholders can drive transformative change in the construction sector, leading to a more sustainable future.

Effective stakeholder engagement

Early Awareness and Education

Align goals with circularity principles

Collaborative Decision-Making

Involve diverse perspectives to shape sustainable directions

Clear Governance and Policy Support

Regulatory guidance for meeting circular standards. And early feasibility assessments if ideas comply with regulations

Transparent Communication

Encourage accountability and open information sharing

Improving network density

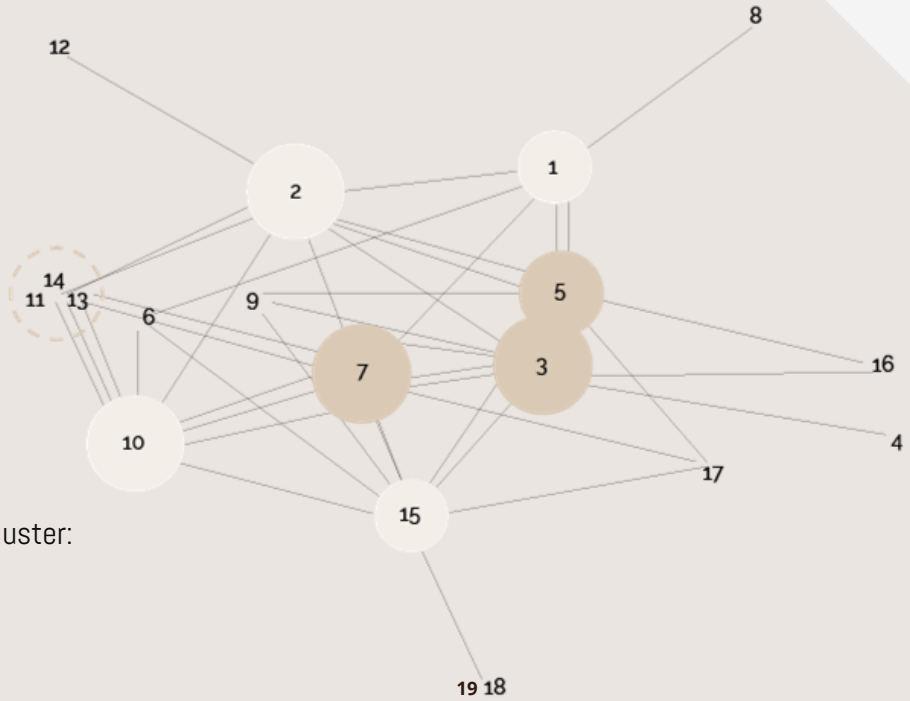
A higher density in enhances collaboration, improves information flow, and supports a cohesive project environment

Density of network before

17%

Density of network after

25%



- Formation of a cluster:
  - Municipality
  - Consultants
  - Engineers

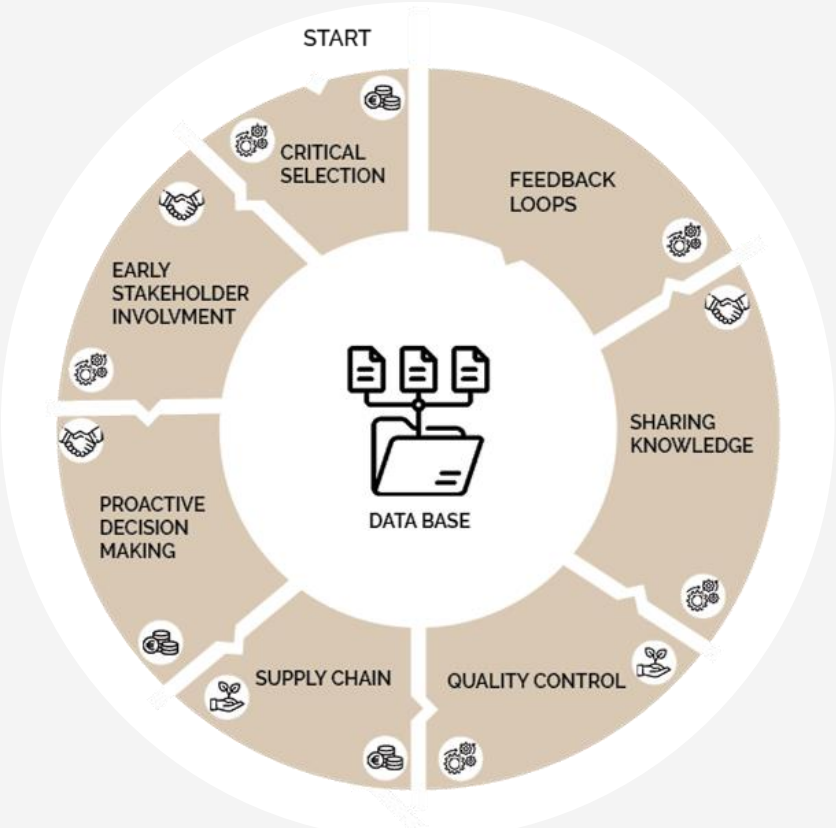
Increased involvement of the municipality:

- Involve the municipality **(11)** from the start of the project to ensure their input and support throughout the project lifecycle.
- Enhance communication channels between the municipality **(11)** and other stakeholders to facilitate timely decision-making and project approvals which is supported by the cluster above.

Enhanced collaboration with the fire department:

- Link the fire department **(19)** with suppliers **(15)** , constructors **(7)**, and the municipality **(11)** for earlier approval of materials.
- Establish connections between the fire department **(19)** and the university **(17)** to support the development of new materials. This collaboration will ensure that research efforts align with regulatory and safety standards.

The Wheel of circular engagement



- **Critical stakeholder selection |** Begin by carefully selecting stakeholders whose motivations align with the project's vision for circular housing. Ensure their commitment to sustainability and circular principles.
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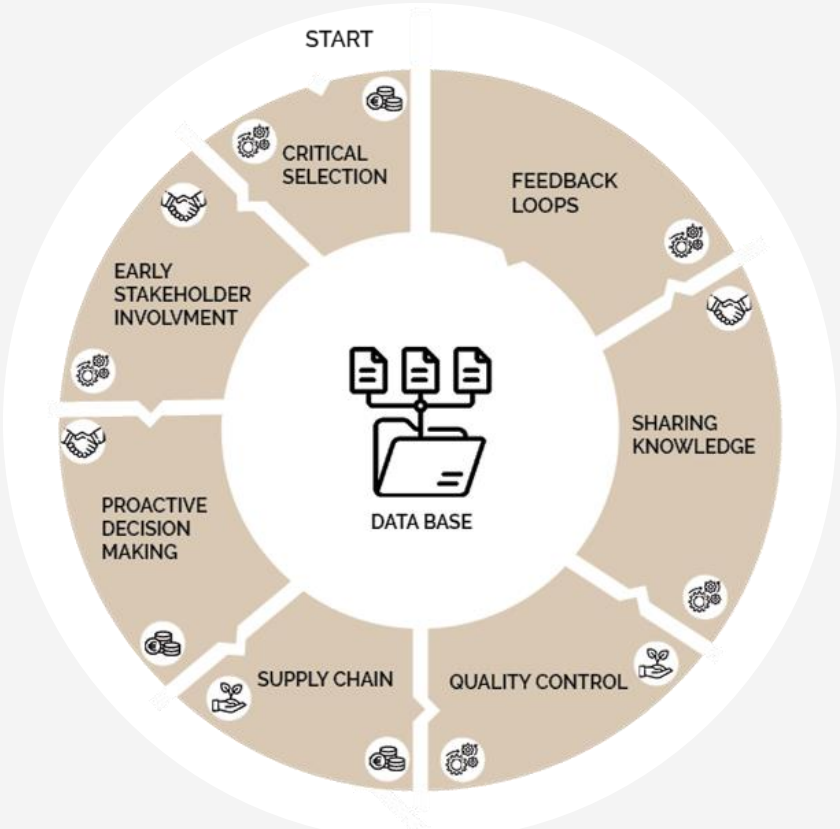
- **Supply chain |** Evaluate the supply chain of materials, including the origin of materials and the availability of recycled materials to meet project demands.

The Wheel of circular engagement



- **Quality control |** Implement a quality control document to maintain circular ambitions throughout the conceptualization and construction phases. Ensure decisions are followed through to implementation.
- **Sharing knowledge |** Facilitate knowledge sharing among stakeholders, both within and between organizations. Foster a collaborative environment that promotes innovation and learning.
- **Feedback loops |** Establish a feedback loop involving all stakeholders to review project outcomes. And discuss the potential lessons that can be learned from the project.

Reflection

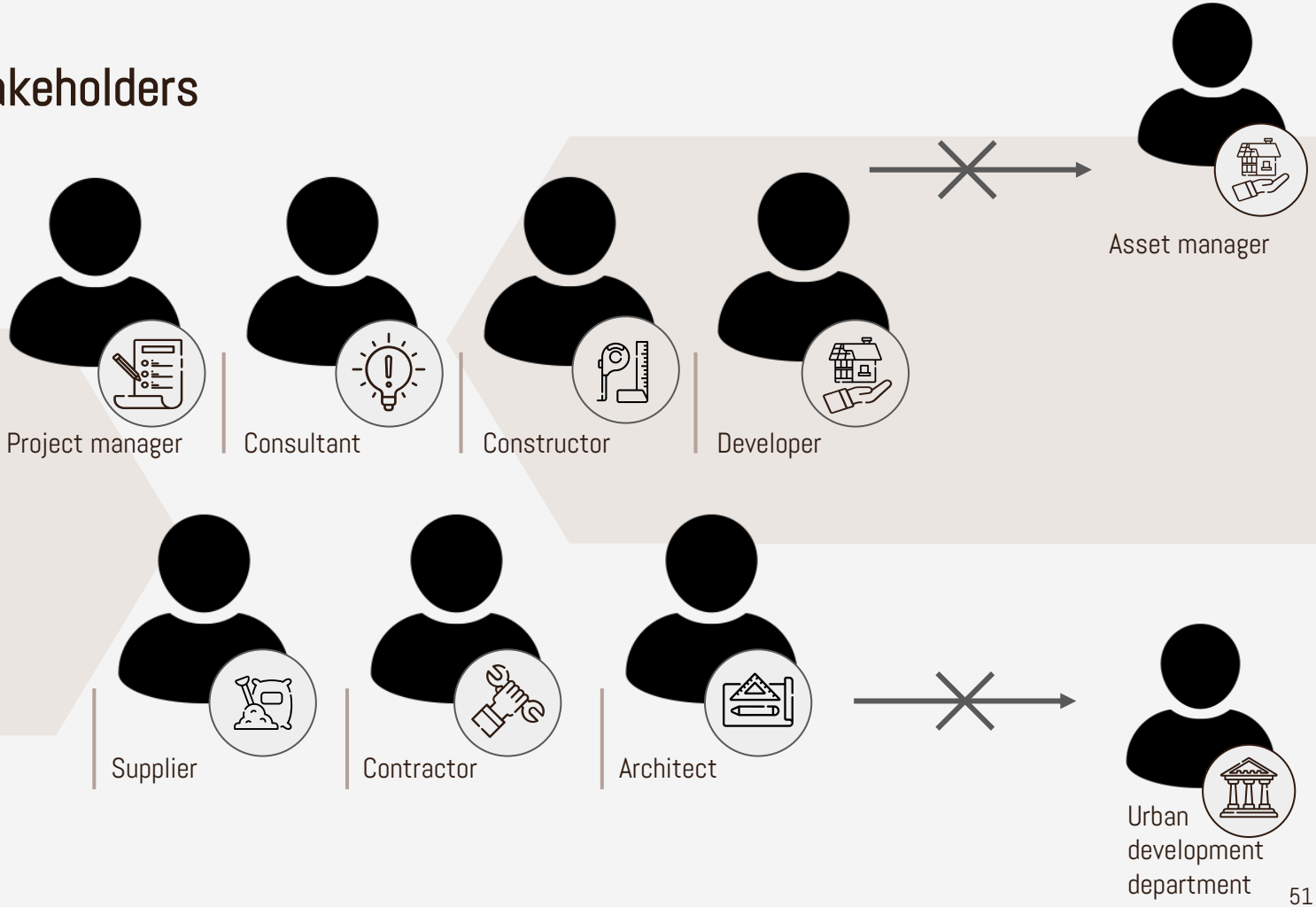
Adjustment of research scope: Shift from broad investigation of circular development goals to focused examination of R-ladder framework in new social housing projects, enhancing feasibility and tangibility.

Refinement of transcript coding schema: Initially, broad coding themes from existing literature provided a foundational framework, yet proved insufficient in capturing data depth. Recognizing this, I adapted, refining the scheme to encompass nuanced insights, highlighting qualitative research iterative nature and the need for flexible methodology

Adjustment in qualitative part of research: Transition from purposive sampling to Snowball Sampling Method (SSM) to accommodate complexities of stakeholder networks in circular housing efforts, fostering trust and collecting comprehensive data.

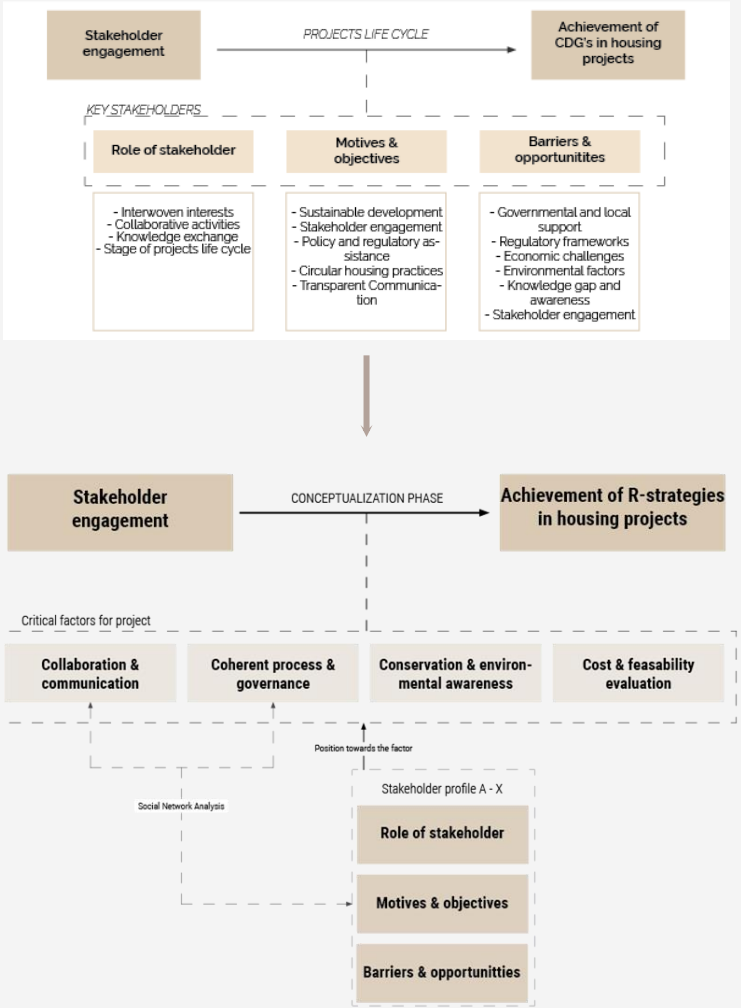
Social network analysis and coding Overcoming initial challenges and learning curve to develop a Python code capable of conducting SNA on stakeholder network data, marking a significant milestone in research career.

Engaged stakeholders

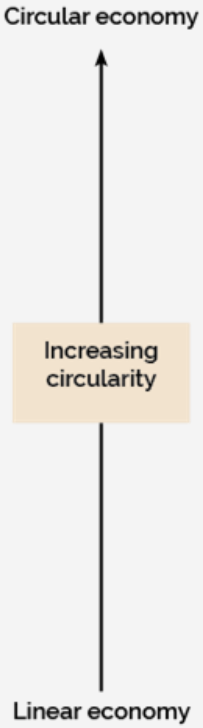


Reflection

Adjustment of conceptual framework: During my research, I refined my broad topic of "circular development goals" to focus on the "conceptualization stage" using the "R ladder framework." This provided clearer guidelines and a concrete basis for analysis. I also redeveloped the factors into the four C's: collaboration and communication, coherent process and governance, conservation and environmental awareness, and cost and feasibility evaluation. By repositioning key stakeholders and integrating social network analysis, I created a more nuanced and actionable conceptual framework.



R-ladder Framework



Smarter creation and use of products	R0 Refuse	Turning a product redundant by cancelling its function, or by substituting it with a radically different product
	R1 Rethink	Intensifying product use (e.g. via product sharing or multifunctional products
	R2 Reduce	More efficient usa and/or manufacture of products trough the use of fewer natural resources and materials
Extending the lifespan of products and parts	R3 Reuse	Reuse of discarded yet still usable product, for the same purpose, by different user.
	R4 Repair	Repair and maintenance of broken or malfunctioning product, to enable continuation of its original function
	R5 Refurbish	Refurbishing and/or modernising andolder product, so that the improved version can be used in the product's orhinal function
	R6 Remanufacture	Using parts of a discarded product in a new product of the same function
	R7 Repurpose	Using discarded products or their parts in new products with a different function
Usefull application of materials	R8 Recycle	Processing of materials to achieve the original high-quality or reduce to low-quality
	R9 Recover	Incineration of materials, recovering their energy

List of Factors Shaping Effective Stakeholder Engagement

- Systematically analyze factors influencing stakeholder engagement.
- Insights gained from the table will guide the qualitative phase of upcoming interviews and will be used in the coding of the interview transcripts.

Factor categories	Stakeholder group	Explanation	Source
Awareness and Education	All Stakeholders	Increase awareness and provide education on circular practices and development goals (CDGs).	J. Yang & Yang, 2014; Salvioni & Almici, 2020
Collaborative Decision-Making	All Stakeholder	Actively involve stakeholders in decision-making processes for circular housing projects. Emphasize collaborative decision-making in a comprehensive approach.	Santos et al., 2019; Salvioni & Almici, 2020; J. Yang & Yang, 2014; Williams, 2022
Policy and Regulatory Assistance	Government Department	Advocate for supportive policy and regulatory frameworks for sustainable development in circular housing projects.	Salvioni & Almici, 2020
Behavioral Changes	All Stakeholders	Recognize the role of stakeholders in promoting behavioral shifts towards sustainability in living environments.	Salvioni & Almici, 2020; Ionescu et al., 2020b; Williams, 2022
Transparent Communication	All Stakeholders	Emphasize transparent communication between stakeholders to realize ambitions and ensure the success of circular housing programs.	Ionescu et al., 2020; Williams, 2022
Economic Barriers	Real Estate Developers	Address economic factors such as upfront costs, ROI concerns, and the need for feasibility studies to overcome barriers to circular development.	Vanegas et al., 2013; Maqbool et al., 2023; Dwaikat et al., 2018; Shen et al., 2010; Ionescu et al., 2020
Diversification of Funding	Real Estate Developers	Consider diversifying funding sources to balance the needs of various stakeholder groups while being mindful of potential fragmentation.	Zhan, de Jong, & de Bruijn, 2018; Kyvelou & Papadopoulos, 2011
Knowledge Exchange	Project Managers	Promote knowledge exchange and shared experiences throughout a project's life cycle to close knowledge gaps between stakeholders.	Hamdan et al., 2021; Andersen et al., 2004; Kalzogg & Hasting, 2011; Li et al., 2018; 2011
Guidance on Sustainability	Consultants	Emphasize the role of sustainability compliance professionals in navigating complex and constantly changing sustainability laws, building standards, and technologies.	Shen et al., 2010; Munaro et al., 2020
Collaborative Approach	All Stakeholders	Stress the importance of a comprehensive and collaborative approach that includes education, stakeholder participation, and the establishment of sustainable supply chains.	Salvioni & Almici, 2020; Hamdan et al., 2021; Andersen et al., 2004
Innovation	All Stakeholders	Acknowledge the need to balance innovation with practical application when integrating environmentally friendly technologies in circular housing projects.	Häkkinen & Belloni, 2011; Shen et al., 2010; Maqbool et al., 2023; Gansmo, 2012

Raw data coding

Raw Data	1ste order concepts	Aggregate dimension
"design team was formed with parties who have experience in timber construction, so to speak."	Collaboration	Collaboration & Communication
"you first have to involve the advisor who has experience in it. So not a consultant that's been around for 100 years. And not an advisor anymore they think sustainability is nonsense."	Experience	
"But there is a fair amount of emailing back and forth. But it also becomes very structural. In the design team. In the preparation phase just like that."	Communication of contact	
"we think in a lot of people the intrinsic motivation to do something with it. And the realization of, uh, if we don't do anything, it stops."	Motivation to participation	
"You do see that at this stage there are still a lot of parties that are not so familiar with it. And who also raise questions in all kinds of areas."	Lack off knowledge	
"Ultimately, those discussions are always between the contractor. And architect and client. That's where the main discussions end up. Architect wants something more in terms of architecture. Or in terms of perception."	Complexity	
"From the government a regulation or look in Amsterdam for example you already have that 20% of the construction should be sustainable. Those kinds of rules that help, of course, also force parties that do not care to think more sustainable."	Steer of government	Coherent process & Governance
"But it is a starting point of what we say, at the beginning of the project is established of, What is the target audience, what is the cost, are we going to build up or down."	Process	
"We give advice. If that does not work, then we put it to the project management and then we can actually say that, we say, we do not give a guarantee on it. "	Responsibility	

"To see how you can shape that whole circularity thing. In the beginning, we did that in the form of experiments. So for example, we built a workshop in Woens Dorp-West, 100% with second-hand materials. We also built a set-up room, entirely with second-hand materials."

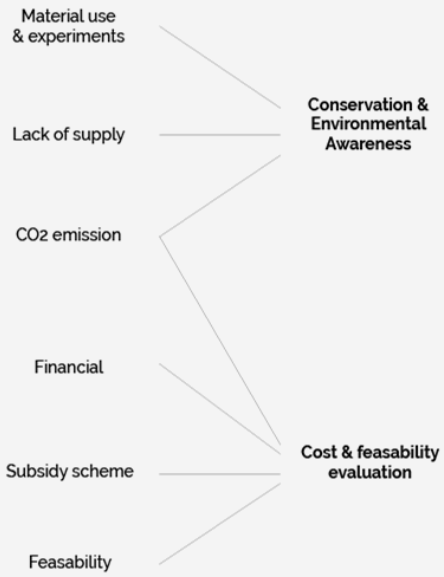
"Well you hope that by applying it more that there is more knowledge. And that it will thus become simpler and therefore cheaper. Or that it will be scaled up. That new products come onto the market. And that it then becomes competitive again with that."

"Also, circular construction. Less pollution. Less disturbance. We spread those kinds of terms in the world as well. But we also see that there are many ambassadors in the Netherlands now. Who are working on that. And also, the law is simply going to come. So that you are less burdensome on the environment. And less CO2. That will also become law soon."

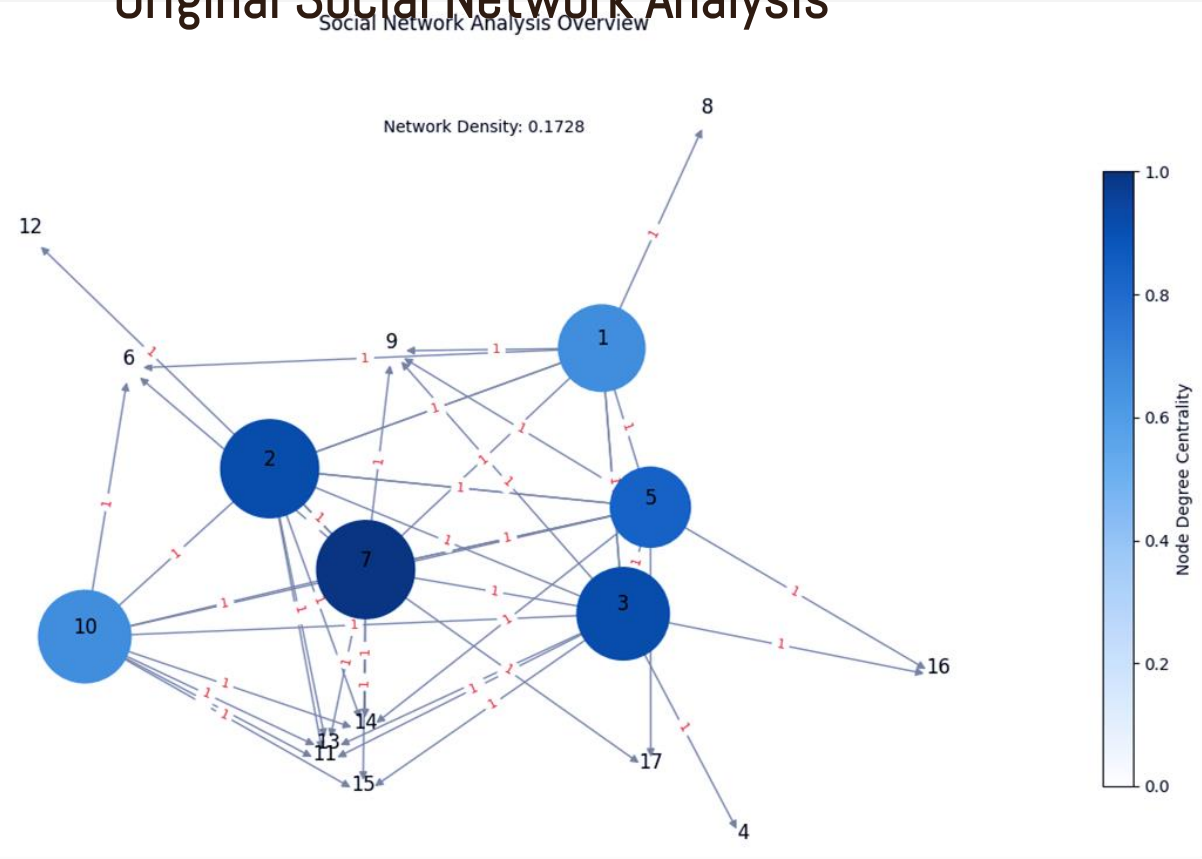
"Especially if there is no claim to that subsidy scheme. Because that does represent the most critical thing currently being assessed. And then you really have to think that for Matchbox. That that really does get a few tonnes of subsidy. So those are pretty dumb if you can't fill them in afterwards. So the financial pressure on that is pretty big."

"So your development costs are currently still high and so is the cost of production, so it will be swept off the table pretty quickly. And so the subsidy bill is one of the triggers in that."

"For example, I'm working on a project where we're getting slightly less return on a project than we would normally like to do. But really taking the next step in sustainability. So that's how I try to tell it then say towards my colleagues. With this project, it is indeed we are not meeting the parameters for what we would normally meet with the project"



Original Social Network Analysis



stakeholder	Node	Centrality
Project developer	1	0.5
Environmental consultant	2	0.666666
Contractor	3	0.722222
Home owners	4	0.055555
Architect	5	0.666666
Instalation specialist	6	0.222222
Constructor	7	0.777777
Landscape Architect	8	0.055555
Client	9	0.277777
Project leader	10	0.5

stakeholder	Node	Centrality
Municipality	11	0.166666
Cost experts	12	0.055555
Consultants	13	0.222222
Engineers	14	0.222222
Suppliers	15	0.611111
Colleagues	16	0.111111
University	17	0.166666
Concrete supplier	18	0.055555
fire department	19	0.055555

Structure of master thesis