INVESTING IN CIRCULAR TRANSFORMATION

Proposal of how to make feasible circular transformation of underperforming buildings with a new organisation structure.

Graduation Presentation
Khushboo Asrani
4745213
28th June, 2019
40% of the total waste in the Netherlands is a result of the construction sector.

22 Million Tonnes of Mineral Waste
+ 1.5 Million Tonne of Wood Waste
+ 1 Million Tonne of Metal Waste

90% of the total construction waste can be recycled.
The vision at EU level for all its member states is to achieve Near Zero Energy Consumption by 2050 for the entire building stock. (EPSR, 2016)
The vision at the Netherlands level is to reduce the consumption of raw materials by 2030 by 50% and transform into a running circular economy by 2050. (EPSR, 2016)
This leads to the following vision by the Dutch Government for the Real Estate sector: “By 2050, the construction industry will be organized in such a way, with respect to the design, development, operation, management, and disassembly of buildings, as to ensure the sustainable construction, use, reuse, maintenance, and dismantling of these objects.” (Circular Economy, 2016)
Built form required for 2050

Market Focus ← New construction

Transformation of existing built form

Research Focus

1/3

2/3

EPSR, 2016
Vision of the Netherlands for 2050

Sustainable energy consumption

Circular construction

Road map for transition

Built form required for 2050

New construction

Transformation of existing built form

1/3

2/3

Barriers
Vision of the Netherlands for 2050

(Sustainable energy consumption + Circular construction)

Road map for transition

Built form required for 2050

1/3 New construction + 2/3 Transformation of existing built form

Barriers

Legislative
Operational
Attitude
Technology
Financial
Structural
Financial and economic barriers
Mutual benefits for all partners
Product Pricing

Table showing barrier in transforming to circular economy:
1- Ritzen & Sandstrom (2017), 2- Oghazi and Mostaghel (2018), 3- World Economic Forum
### Table showing barrier in transforming to circular economy

<table>
<thead>
<tr>
<th>Barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational barriers</td>
</tr>
<tr>
<td>Cultural barriers</td>
</tr>
<tr>
<td>Lack of channel control</td>
</tr>
<tr>
<td>Trust among partners</td>
</tr>
</tbody>
</table>

1- Ritzen & Sandstrom (2017), 2- Oghazi and Mostaghel (2018), 3- World Economic Forum
Problem Statement:

All office stock has to comply with a minimum of label C by 2023, which implies that **34.6 million square meter** of office stock needs to be renovated. (Cadastre, 2018)
Problem Statement:

Current Issues in the Dutch Real Estate Sector

Offices with energy label below C will be prohibited by 2023

1 million new homes needed by 2030
Problem Statement:

To make feasible circular transformations to address the requirement of housing and transforming underperforming office buildings.
Main Research Question:

How would it be feasible to invest in circular transformation for a future proof-built environment & what would be the roadmap for it?
Main Research Question:

How would it be feasible to invest in circular transformation for a future proof-built environment & what would be the roadmap for it?

Sub Questions:
What is circular economy in the built environment?
Main Research Question:

How would it be feasible to invest in circular transformation for a future proof-built environment & what would be the roadmap for it?

Sub Questions:
What is circular economy in the built environment?
How would the new organisation structure for a transformation process function?
Main Research Question:

How would it be feasible to invest in circular transformation for a future proof-built environment & what would be the roadmap for it?

Sub Questions:
What is circular economy in the built environment?
How would the new organisation structure for a transformation process function?
Which stakeholders would be involved in the process and what would their roles be?
Main Research Question:

How would it be feasible to invest in circular transformation for a future proof-built environment & what would be the roadmap for it?

Sub Questions:
What is circular economy in the built environment?
How would the new organisation structure for a transformation process function?
Which stakeholders would be involved in the process and what would their roles be?
If and how it is feasible for investors to conduct circular transformation?
Conceptual model:

- Circular construction
  - Barriers
  - Operational
    - Financial
      - Structural
    - Attitude
    - Technology
    - Legislation
  - Transform barriers
  - Results: check whether scheme is successful

- Operational cycle
  - Building Owner
  - Supplier circuit
    - Built form + land
    - Users + Resale
  - Opportunities

- Decide the strategies of circular transformation
- Create organisation structure for circular transformation
- Develop the functioning of a business model around the new structure
- Test organisation & implications in MOR pilot project

- Literature Study
- Market perspective (Interviews)
- Literature Reference
- Market inputs (MOR partners input)
- Market inputs (Interviews)
Name: MOR (Modular Office Renovation)

Location: Marconi Tower in the M4H district in Rotterdam

The project concept: Net positive, Mixed Function, Circular, Transformation----- Future Proof Built Environment

Why this Case:
The pilot study focusses on relevant topics of the near future, displaying the functioning efficiently. Since I am part of the student team it is easier to understand the project complexities more thoroughly.
The Method adopted for this study is Hybrid in nature.

There has been an extensive literature review on the topics and then a set of explorative interviews conducted with real estate advisors.

The overall study can be divided in 3 main topics:
- Background
- Stakeholders
- Business model
The interviews were important because a lot of literature available was repeated without addition of new relevant data.

The companies selected were based on the kind of investments they give direction to, this would give an over perspective on the way different investments flow, their vision and probability of investing in CE.

The range covers pension funds, private funds, public funds, foreign investments
Methodology:

Questionnaire to the MOR partners about the product lifespan,
cost of production,
extent of dismantling possible within the product,
value of product after lifespan,
willingness to move towards product as a service
implications moving towards product as a service
The interviews were important because a lot of literature available was repeated without addition of new relevant data.

There is major gap of what is proposed in theory and in practice.

Understanding different perspectives broadened the idea of circularity in the building sector.

Interviews with Developers - Egeria & Reborn to understand the financial implication of circular and regular investments.
Circular construction

What does circular economy mean in the built environment?
“A building that is developed, used and reused without unnecessary resource depletion, environmental pollution and ecosystem degradation. It is constructed in an economically responsible way and contributes to the wellbeing of people and the biosphere. Here and there, now and later. Technical elements are demountable and reusable, and biological elements can also be brought back into the biological cycle.”
Impact- micro, meso, macro, built environment & eventually natural environment

The effects of which are seen in the Material recycling, renewable energy, circular use of water, Support biodiversity, Human society are preserved, Wellbeing of all species, Generate value in measures beyond just financial.
Measuring the Impact:
The MCI calculation proposed by Ellen MacArthur foundation in 2015, results in a circularity rating based on the reusability of the materials, energy consumption, etc. This works as an effective framework to evaluate the circularity of each product entering into the building.
The built environment is extremely circular at the Site and Structure which is reused or redeveloped and used. This constant idea of reusing needs to translate into the Skin, Services, Space planning and Stuff.
Which stakeholders would be involved in the process and what would their roles be?
Strategically plan the desired outcome and monitor the project. Responsible to initiate the process. Build the team for the project. Service provider selections based on desired rents.
Plan changes based on market conditions to maximize profit for building owner.
Responsible for the operation of the project and plan for the next cycle of use. Coordinates between the user, service providers and the building owner. Monitors material selection in order to change the function quickly.
Pay and utilize services, expect cheap rents along with standard of living, while being responsible to the environment.
Supplier move from suppliers to service providers, responsible for the life cycle and maintenance of the product along with the materials at the end of its use life.
Access the existing structure and materials and responsible to design with the existing materials and design for adaptive reuse of the spaces.
Make detachable connections during the construction phase and coordinate with the different service providers.
Supplier of resources to manufacturers and contractors.
Suppliers of materials which are not available or cannot be reused
SUPPLY

Legislation

Act as a facilitator and provide the necessary infrastructure

MONITOR

Legislation

Setting policies and implementing changes to facilitate the functioning of the system

DEMAND

Investor/owner

Act as a facilitator and provide the necessary infrastructure

Product as Service Providers

Secondary Resource Provider

Virgin Resource Provider

Strategic

Asset

Activity

Technical

Strategic

Asset

Activity

Technical

Investor/owner

Product as Service Providers

Secondary Resource Provider

Virgin Resource Provider

Legislation

Facility Manager

Municipality

User

Contractor

Architect & Urban planner

Asset Manager

Municipality

Legislation

Strategies

Structure

Roadmap

Definition

Impact Area

Strategies

Structure

Roadmap

Topic & Problem Statement

Research Question

Research Design

Research Output

Conclusion & Discussion
Assumptions

The following assumptions help develop the new organizational structure and the working of it.

Blockchain: The high risk based investors move to investing in the supply chain.
The following assumptions help develop the new organizational structure and the working of it.

- Blockchain: The high risk based investors move to investing in the supply chain.
- Virgin materials: The cost of virgin materials is expensive.
The following assumptions help develop the new organizational structure and the working of it.

Blockchain: The high risk based investors move to investing in the supply chain.

Virgin materials: The cost of virgin materials is expensive.

Taxation: Tax rebate for users of circular buildings to create a demand in the market (initiation phase).
The following assumptions help develop the new organizational structure and the working of it.

1. **Blockchain**: The high risk based investors move to investing in the supply chain.
2. **Virgin materials**: The cost of virgin materials is expensive.
3. **Taxation**: Tax rebate for users of circular buildings to create a demand in the market (initiation phase).
4. **Adaptable Land Use**: Owners ready to transform in a circular way get the leverage of a mixed use plot, increasing the value of it (initiation phase).
The following assumptions help develop the new organizational structure and the working of it.

Blockchain: The high risk based investors move to investing in the supply chain.

Virgin materials: The cost of virgin materials is expensive.

Taxation: Tax rebate for users of circular buildings to create a demand in the market (initiation phase).

Adaptable Land Use: Owners ready to transform in a circular way get the leverage of a mixed use plot, increasing the value of it (initiation phase).

Negative Discounting: In case the owner chooses to not transform, he receives a negative discounted rate for the plot and the municipality auctions the plot for circular transformation.
The following assumptions help develop the new organizational structure and the working of it.

Blockchain: The high risk based investors move to investing in the supply chain.

Virgin materials: The cost of virgin materials is expensive.

Taxation: Tax rebate for users of circular buildings to create a demand in the market (initiation phase).

Adaptable Land Use: Owners ready to transform in a circular way get the leverage of a mixed use plot, increasing the value of it (initiation phase).

Negative Discounting: In case the owner chooses to not transform, he receives a negative discounted rate for the plot and the municipality auctions the plot for circular transformation.

Online Platforms: All the online platforms are functional.
How would the new organisation structure for a transformation process function?
**Investor (facility manager) - user**

**Availability of shared facilities, cost based on usage**

**Profit sharing (Blockchain)**

**User type and units required, maintenance & operation (IoT, Material Passport)**

**Definition**

**Impact Area**

**Strategies**

**Structure**

**Roadmap**

**Online Platform 3**

**Commissioners**

**Facility Manager**

**Contractor**

**Consortium**

**Asset Manager**

**Investor**

**Architect**

**Module-wise Service Sectors**

**Online Platform 2**

**Online Platform 1: INVESTMENT**

**User A**

**User B**

**User C**

**Topic & Problem Statement**

**Research Question**

**Research Design**

**Research Output**

**Conclusion & Discussion**
Supplier- (Investor + Designers)

Requirement of material, component or products

Availability of components or materials at the end of the lifespan

Performance of product, time of availability, price, number of units, current location

Impact Area

Strategies

Structure

Roadmap
Municipality - Investors
Available buildings and their location, level of circularity, current suppliers, probable function as per market needs, cost

Municipality - Users
Availability of unit, tenure of contract, rent per month, level of circularity (for tax discounting),

Municipality - Supplier
Requirement of module types- based on market condition
Investor owns a vacant/underperforming building. Keeping in mind the potential of the existing structure and site, a decision is made to transform the existing structure.
Investor appoints an asset manager to plan for the next life of the project. The probable programmes and target audience are decided as per the market requirements. The online platform helps the asset manager understand the market needs and probable competitors.
The architect is appointed to develop a proposal for the existing building.
The contractor is appointed to extract the resources not going to be used within the building during transformation. The secondary resource manager can use these resources by testing its strength and providing it to the service developers (suppliers).
The online platform helps the team choose for the modules to be inseted during transformation. This would be based on the performance, leasing amount, availability, number of modules available. This results in the final design for execution.
The service providers selected by the Owner, facility manager, architect & engineers and the contractor come together to create a coalition. A consortium is developed between the service providers and the contractor to insert the products into the building in a demountable method. The consortium is in an agreement with the owner of the building for a fixed tenure. The service providers are responsible for the maintenance and operation of the modules.
The service providers maintain the units along with the facility manager. The users pay for the services they use and it is divided on profit sharing bases between the stakeholders to ensure smooth functioning of the building for the stipulated period.

The diagram illustrates the phases of the project:

- Phase 1: Initiation & Dismantling
- Phase 2: Design & Construction
- Phase 3: Operation & Maintenance

Key stakeholders and their roles:

- **Municipality**
  - Users: Availability of unit, tenure of contract, rent per month, level of circularity (for tax discounting)
  - Supplier: Requirement of module types—based on market condition

- **Service Providers**
  - Investor (facility manager) - user: Availability of shared facilities, cost based on usage

The diagram shows the flow from a vacant building through the phases, highlighting the involvement of different stakeholders at each stage.
The investor does the evaluation with the asset manager and either plans for the next phase or decides to sell the property. There is a possibility to sell the building with the consortium of the service providers or only the site and structure. In the case of only site and structure, the service providers are supposed to take down their modules as per their tenure contract in the supervision of the facility manager.
In case the owner decides to continue on the same plot, a market evaluation could be conducted to figure the probable programme for the future use and the contract with the same service providers or new ones could be established. Creating a cyclic process. This is due to the incorporation of the smart service infrastructure in the building.
MOR pilot study

This study is compares on different scenarios based on investments made by different stakeholders within the process. The outcome reflects the return on investment for the owner in different scenarios.
MOR pilot study

<table>
<thead>
<tr>
<th>Supplier- (Investor + Designers)</th>
<th>Performance of product, time of availability, price, number of units, current location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Products being leased</td>
<td>Monthly product lease</td>
</tr>
<tr>
<td>Façade</td>
<td>€107</td>
</tr>
<tr>
<td>External Walls</td>
<td>€13</td>
</tr>
<tr>
<td>Folding garden partitions</td>
<td>€33</td>
</tr>
<tr>
<td>Internal partitions</td>
<td>€9</td>
</tr>
<tr>
<td>Bedroom partition</td>
<td>€20</td>
</tr>
<tr>
<td>Green Wall</td>
<td>€214</td>
</tr>
<tr>
<td>Flooring</td>
<td>€18</td>
</tr>
<tr>
<td>Ceiling island</td>
<td>€3</td>
</tr>
<tr>
<td>Kitchen and Bathroom</td>
<td>€132</td>
</tr>
<tr>
<td>Bedroom Module</td>
<td>€39</td>
</tr>
<tr>
<td>Chair and Table</td>
<td>€48</td>
</tr>
<tr>
<td>Locker</td>
<td>€1</td>
</tr>
<tr>
<td>Other furniture</td>
<td>€5</td>
</tr>
<tr>
<td>Core Services</td>
<td>€44</td>
</tr>
</tbody>
</table>
Scenario 1

This scenario depicts the current situation. Where the investor makes all the investment along with taking the initiative for the project
Owner: Site + structure + skin + service + spatial planning + stuff
Service Providers:
Scenario 1

This scenario depicts the current situation. Where the investor makes all the investment along with taking the initiative for the project.

Owner: Site + structure + skin + service + spatial planning + stuff

Service Providers:

Expected Investment & Return

- 101,663,475
- 7.91%
Scenario 2

Owner: Site + structure + skin + service + spatial planning
Service Providers: Service + Spatial planning + stuff

34% Service provider’s investment

66% Owner’s investment
Scenario 2

Owner: Site + structure + skin + service + spatial planning
Service Providers: Service + Spatial planning + stuff

34% Service provider’s investment
66% Owner’s investment

Expected Investment & Return

IRR: 8.49%
Investment Cost: 57,512,884
Scenario 3

This scenario depicts a futuristic vision
Owner: Site + structure + service + spatial planning
Service Provider: Skin + Service + Spatial planning + stuff
This scenario depicts a futuristic vision
Owner: Site + structure + service + spatial planning
Service Provider: Skin + Service + Spatial planning + stuff
How would it be feasible to invest in circular transformation for a future proof-built environment & what would be the roadmap for it?
Increase in returns

Reduced Investment

Current (2019)

Road map for transition (2050)
Designing the Scheme for the future

A study of the typologies of existing architectural buildings could be conducted and following the scheme the transformation could be adopted and implemented for the typologies.

Testing the feasibility of conducting the transformation- financial, structural, adaptable, etc.

The proposed design for the transformation must facilitate maximum spacial flexibility and adaptability.

The transformation must be made keeping in mind the limitations of the typology.

The requirement in terms of function can be determined by the municipality and the limitations of the typology.

However, the limitations exist with architecturally standing out buildings.
Scheme for the future

CURRENT OWNERSHIP STRUCTURE

EXECUTERS
Service Providers
Architect & engineers
contractors
consultants
Managers

FACILITATORS
Legislation
Municipality

COMMISSIONER
Building Owner
User

STUFF
SPATIAL PLANNING
SERVICES
SKIN
STRUCTURE
SITE

Research Question
Research Design
Research Output
Conclusion & Discussion

Topic & Problem Statement

73
Scheme for the future

CURRENT OWNERSHIP STRUCTURE

STUFF
SPATIAL PLANNING
SERVICES
SKIN
STRUCTURE
SITE

EXECUTERS
Service Providers
Architect & engineers
contractors
consultants
Managers

FACILITATORS
Legislation
Municipality

COMMISSIONER
Building Owner
User

PROPOSED STRUCTURE FOR THE MOR CASE

STUFF
SPATIAL PLANNING
SERVICES
SKIN
STRUCTURE
SITE

EXECUTERS
Service Providers
Architect & engineers
contractors
consultants

FACILITATORS
Legislation
Municipality

COMMISSIONER
Building Owner
User
Asset Manager
Project Manager
Facility Manager
Scheme for the future

CURRENT OWNERSHIP STRUCTURE

EXECUTERS
Service Providers
Architect & engineers
contractors
consultants
Managers

FACILITATORS
Legislation
Municipality

COMMISSIONER
Building Owner
User

PROPOSED STRUCTURE FOR THE MOR CASE

EXECUTERS
Service Providers
Architect & engineers
contractors
consultants

FACILITATORS
Legislation
Municipality

COMMISSIONER
Building Owner
User
Asset Manager
Project Manager
Facility Manager

PROBABLE STRUCTURE FOR THE FUTURE

EXECUTERS
Building owners
Service Providers
Architect & engineers
contractors
consultants

FACILITATORS
Asset Manager
Project Manager
Facility Manager

COMMISSIONER
Legislation
Municipality

Site & Problem Statement
Research Question
Research Design
Research Output
Conclusion & Discussion
75
Conclusion

Scientific Relevance
The structure and road-map proposed may not the ideal pathway ahead but is a stepping stone to test the desired outcome. It shows it is feasible for building owners in the long run this could be developed further by different stakeholders to test the feasibility of it.

The outcome from the interviews gave a strong idea of the way the investors and market perceive the topic of circular economy in the built environment and their cone of vision for it.

Their current hesitation of moving towards a circular way of working is due to the legislative barriers and the idea of missing out on incentives in the future. This creates pressure for the government to create milestones and show the market the direction and give incentives to move towards it.

It is also important that the research being conducted does not keep paraphrasing but works towards creating new outcomes and shares it with the construction sector.
Conclusion

Societal Relevance
The research shows that the circular transition does not have to be expensive housing. It is also feasible to provide affordable housing as seen in the MOR case study.

Circular construction can give rise to job opportunities. In the Netherlands alone it is estimated to give rise to 54,000 jobs.

A change in mindset will make users conscious about material usage and in tern service providers about waste and re-usage, thus moving in the direction of the circular economy.
Reflection

Topic of Research
The topic is relatively new and very little research has been done in transforming in a circular way, which should be a major focus.

Process
The initial literature study made me realize that not much work was done in this topic. The interviews gave me a fresh perspective to perceive the ongoing research. This got me a little lost in the process but eventually got a grip of the purpose of this study. The research post the interviews were specific to learn more on certain topics which would impact the final outcome. The enthusiasm of the participants really gave a momentum to my study.

Result
The structure proposed may not be the final one but helps give an overall understanding of the working of the topic. It definitely opens up discussion about the way ahead.
Recommendation & Limitations

- Architectural typology & image of the city
Recommendation & Limitations

- Architectural typology & image of the city
- Marketing circularity
Recommendation & Limitations

- Architectural typology & image of the city
- Marketing circularity
- Change in mindset
**Recommendation & Limitations**

- Architectural typology & image of the city
- Marketing circularity
- Change in mindset
- Changed Roles of Stakeholders - developer
Recommendation & Limitations

- Architectural typology & image of the city
- Marketing circularity
- Change in mindset
- Changed Roles of Stakeholders- developer
- Concept of ownership
Recommendation & Limitations

- Architectural typology & image of the city
- Marketing circularity
- Change in mindset
- Changed Roles of Stakeholders - developer
- Concept of ownership
- Attitude, Technology, Legislation Barriers
**Recommendation & Limitations**

- Architectural typology & image of the city
- Marketing circularity
- Change in mindset
- Changed Roles of Stakeholders - developer
- Concept of ownership
- Attitude, Technology, Legislation Barriers
- Evaluation system does not consider environmental and social issues and is only weighed financially
Recommendation & Limitations

- Architectural typology & image of the city
- Marketing circularity
- Change in mindset
- Changed Roles of Stakeholders - developer
- Concept of ownership
- Attitude, Technology, Legislation Barriers
- Evaluation system does not consider environmental and social issues and is only weighed financially
- Infrastructure needed
Recommendation & Limitations

- Architectural typology & image of the city
- Marketing circularity
- Change in mindset
- Changed Roles of Stakeholders - developer
- Concept of ownership
- Attitude, Technology, Legislation Barriers
- Evaluation system does not consider environmental and social issues and is only weighed financially
- Infrastructure needed
- Rules and regulations
“An experiment does not have to be perfect – experiments
can open the way for something radically new!”

-Soren Hermansen
(presentation at TU Delft)

Thank you!