Adaptable Real Estate

The added value of adaptability in a long-term business case

P5 Presentation
Bauke Brekelmans - 4962745

TU Delft
BK Bouwkunde

RE:BORN

"We should not try to forecast what will happen,

but try to make provision for what cannot be foreseen."

- John Habraken (1961)

Table of Content

I. Introduction

Urbanization

"In 2050, 66% of the world population is expected to live in urban areas."

(United Nations, 2014)

Housing shortage:

"Currently there is a housing shortage of 331.000 dwellings and by 2025 this shortage will have grown to 419,000."

(Primos & CBS, 2020)

Vacancy:

"The total vacancy rate in real estate amounted to almost 30 million m^2."

(Landelijke Monitor Leegstand, 2020)

As a result...

Mismatch between demands, needs and desires, and what is already available.

Designed for one function.

Focus on the short-term during development.

So we have to create more adaptable buildings.

However...

The current financial models do not recognize value and risk in their most comprehensive form, namely over the long run and taking adaptability into account.

Need to be viewed over their whole life, taking multiple functions into account.

Focus on both Capital Expenses (CapEx) and Operational Expenses (OpEx).

Shift from the current linear economy of 'take- make-dispose', to a future circular economy.

Problem statement

*"**The take-up of adaptability in new developments** is not as high as is desirable from a social and environmental point of view. The main cause is that adaptability is thus far **not motivating** long-term owners and investors financially, while theory says that it certainly has financial benefits in the long run. (...) Most mentioned problems are related to **the financial model that is currently used.** Since this financial model is created in a linear economy, it has **difficulties with the implementation of circular conditions** such as adaptability. **The value of adaptability is unseen** and can therefore be regarded as **lost value**, since it is neither captured nor measured in the business case. It is believed that for a large step towards a more durable real estate stock, the **business case and financial reasoning need adjustments.**"*

Main goal

“To make the financial benefits of adaptability visible and workable.”

In order to…

1. Raise awareness.
2. Have better implementation in practice.

Larger effects:

- Decrease the vacancy rate
- Maximize the value of embedded resources
- Minimize the usage of ‘virgin’ resources and the emission of CO_2

Output

Conditions for an improved long-term business case and approach that takes adaptability and its benefits better into account.

Focus

Research focuses on tall buildings specifically.

Why?

- Replicability
- Expressed in extreme:
  - Environmental impact: The amount of materials, CO_2 emissions.
  - Social impact: Landmark in city.
  - Financial impact: Development costs, and therefore also adaptability investments, the amount of stakeholders involved.

How will I do that?

Research questions

"What business model and financial model are most appropriate for real estate organizations to achieve increased adaptability in tall buildings?"

SUB-QUESTIONS

What features have to be incorporated in order for a tall building to be adaptable?

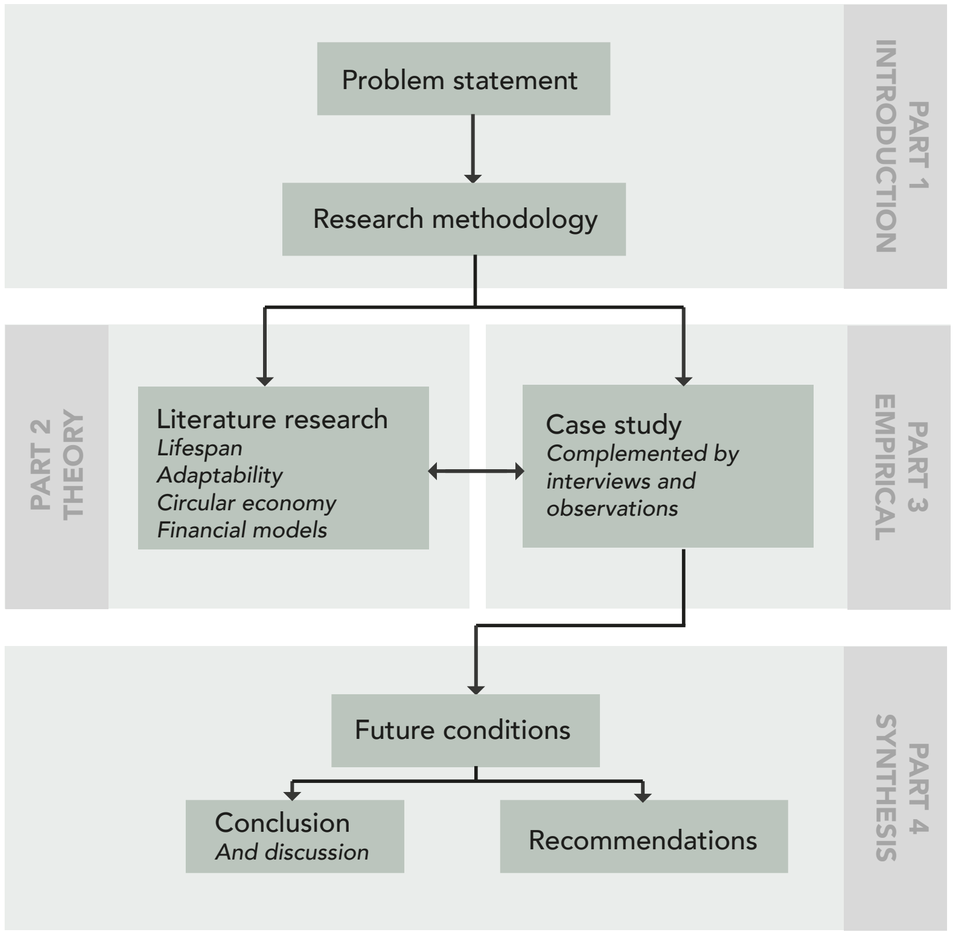
How can the lifespan be defined for a tall building in a circular way?

What is the influence of adaptability on the current business model and case?

How can the financial model be changed so that adaptability benefits and costs are taken better into consideration?

Research method

And how do they relate to each other?



LITERATURE STUDY

Sub-question 1
What features have to be incorporated in order for a tall building to be adaptable?

Sub-question 2
Which approach for a long term lifespan (for an adaptable building) can be best used?

CASE STUDY

Sub-question 3
To what extent is adaptability taken into account in the current financial model?

Sub-question 4
How can the financial model be changed so that adaptability benefits and costs are taken better into consideration?

Research method

1. Collect.
2. Validate.
3. Implement.

Research method

1. Collect.
2. Validate.
3. Implement.

1. Raise awareness.
2. Better implementation in practice.

Research method

1. Collect.
2. Validate.
3. Implement.

Literature findings

II. Literature

Literature topics

1. Lifespan
2. Adaptability
3. Circular economy
4. Financial models

Literature topics

1. Lifespan
2. Adaptability

Research questions 1 & 2

3. Circular economy
4. Financial models

Background information

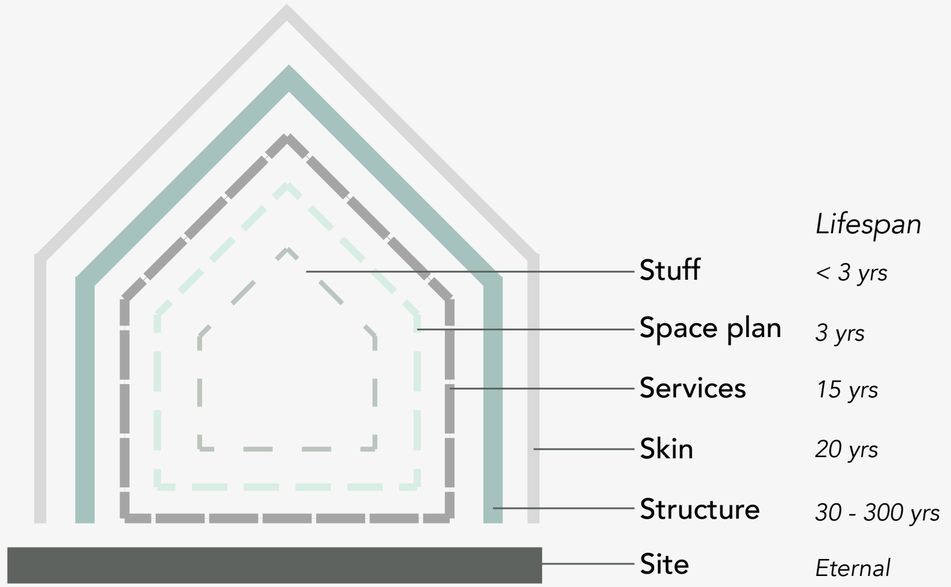
Lifespan

Literature findings

Lifespan

- Estimation of time
- Building lifespan of 50 years
- Often longer in practice

- Lifespan of building vs. elements
- Layers of Brand (1994).



Layers of Brand

Adaptability

Literature findings

Adaptability

- Definition (Schmidt et al. (2014)

"The capacity of a building to accommodate effectively the evolving demands of its context, thus maximising its value through life."

- Adaptability is a means, not an end.

- Flexibility vs. adaptability.
  Changes within a building vs. allowing changes by adapting the building.

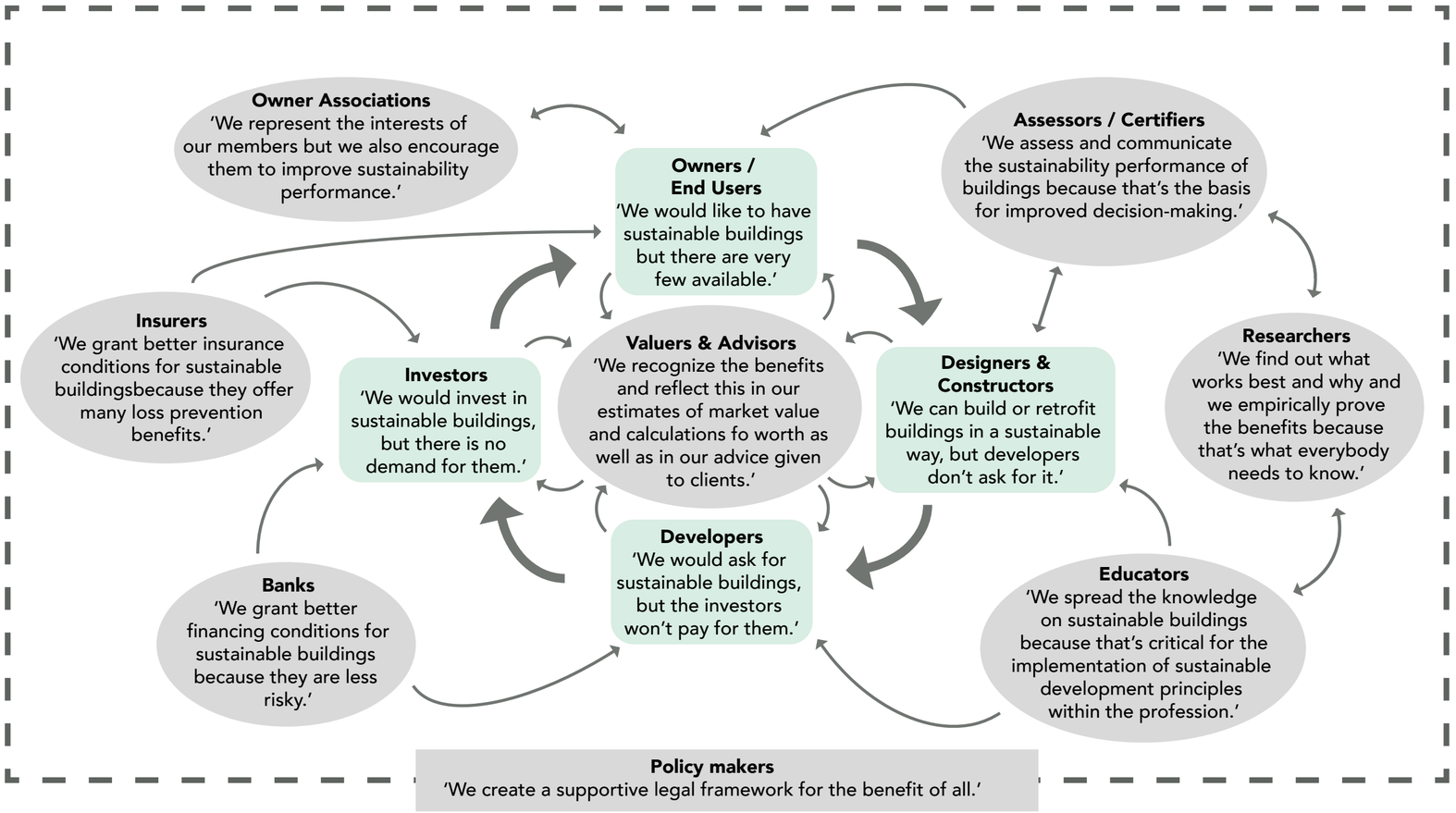
Table of adaptable features

Legal	
	Land-use plan flexibility.
	Building Decree compliance.
Technical	
Structure	Generic and flexible layout: a central core or horizontal corridor.
	Free floors; Wide floor slabs loadbearing in two directions.
	Grid measurement of 1,8 m preferred.
	Small span core to facade; 5,4 m - 7,2 m - 9,0 m.
	Floor-to-floor height 3,6 m.
	Possible for horizontal floor extensions.
Skin	Design the facade as demountable and adaptable.
	Keep distinction between long-cyclical and short-cyclical facade.
Services	Locate services around or in the core.
	Never integrate services with structure.

Literature findings

Adaptability

Circle of blame, and how actors could react



(RICS, 2008)

Circular economy

Literature findings

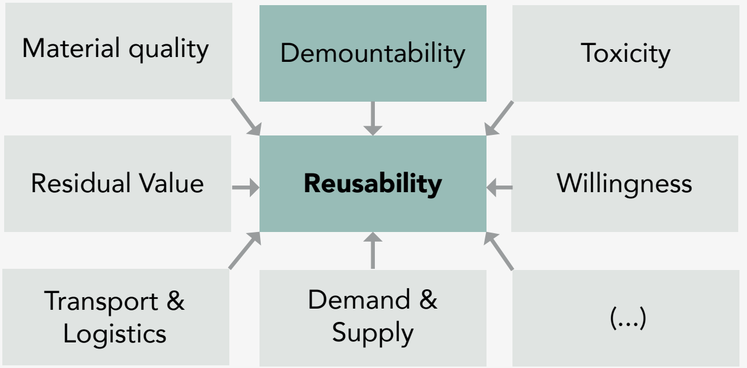
Circular economy

"Extend the life of products as long as possible, with having the highest value possible."

Reuse on three levels:
- Element
- Product (component)
- Material

Demountability

Total Cost of Ownership vs. Circular Economy



(Van Vliet, 2018)

	Traditional	TCO	Circular Economy
Investment costs (NEN 2580)	X	X	X
Land costs	X	X	X
Construction costs	X	X	X
Interior costs	X	X	X
Additional costs	X	X	X
Operational costs (NEN 2632)	X	X	X
Fixed costs	X	X	X
Energy costs			X
Maintenance costs		X	X
Administrative management costs		X	X
Facility costs (NEN 2748)			X
Security			X
Interior cleaning			X
Facade cleaning			X
Life cycle costs		X	X
Life extending costs i.e. rejection, extension or rearranging flexibility			X
Reinvestments		X	X
Incomes	X	X	X
Sell / rent	X	X	X
Yield		X	X
Residual value of real estate			X
(Re)cycle thinking			X
Ecological value			X
Economical value: Upcycling, downcycling or reuse			X
Residual value on component level			X

(Brink groep, 2014)

Literature findings

Circular economy

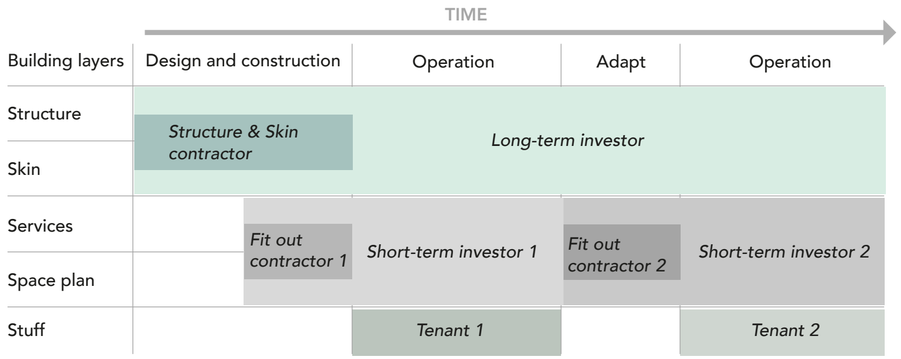
Five innovative business models (Lacy & McNamara, 2014)

- Product As A Service (PAAS)
- Resource Recovery.
- Product Life Extension.
- Sharing Platforms.
- Circular Supplies.

Shift from ownership to usage. Different forms on spectrum:

- Buy
- Financial lease
- Buy or lease with buy-back guarantee
- Operational lease
- Full service lease
- Pay-per-use

Business model Adaptable Assets:

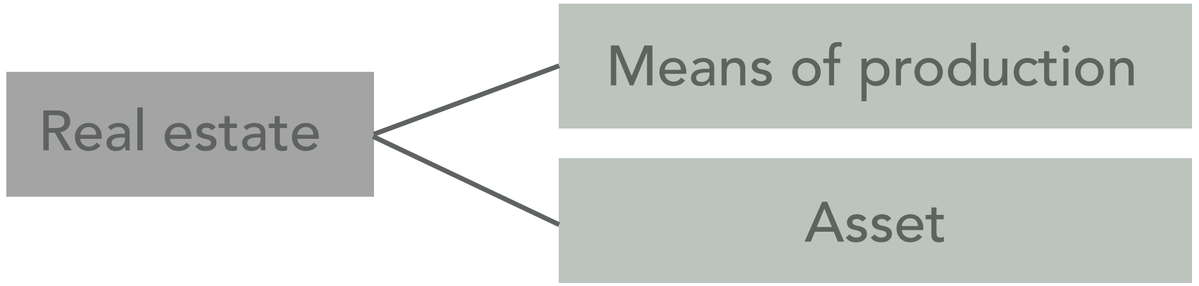


(ARUP & Ellen MacArthur Foundation,2020)

Financial models

Literature findings

Financial models



Physical
Financial

Financial

Should also focus on **Physical** **Financial**

Static methods: Gross Initial Yield
Net Initial Yield

Dynamic methods: Net Present Value
Internal Rate of Return

Literature topics

1. Lifespan ✗
2. Adaptability ✓

Research questions 1 & 2

3. Circular economy
4. Financial models

Background information

Research method

1. Collect.
2. Validate.
3. Implement.

Case study

III. Case study

Selection

- **Tall building**

  > 70 m

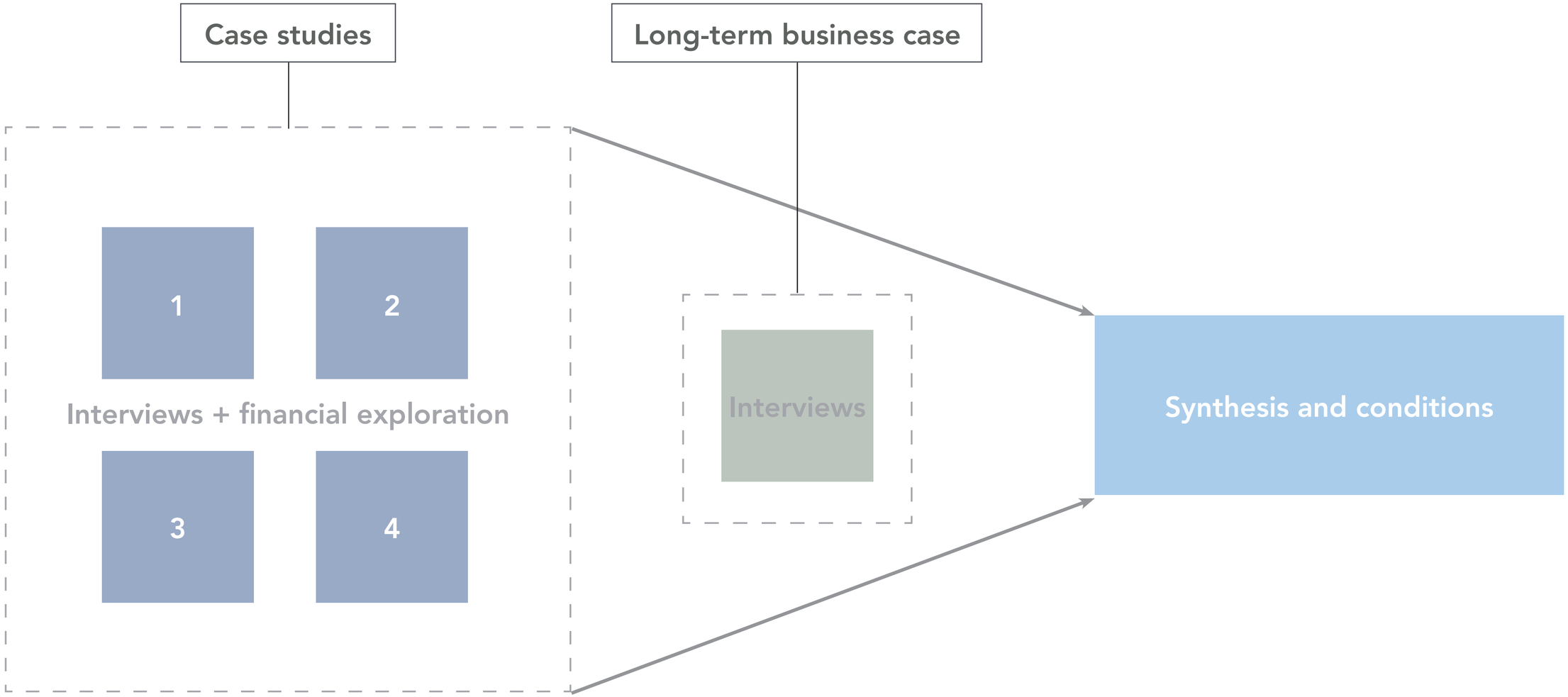
- **Transformation**

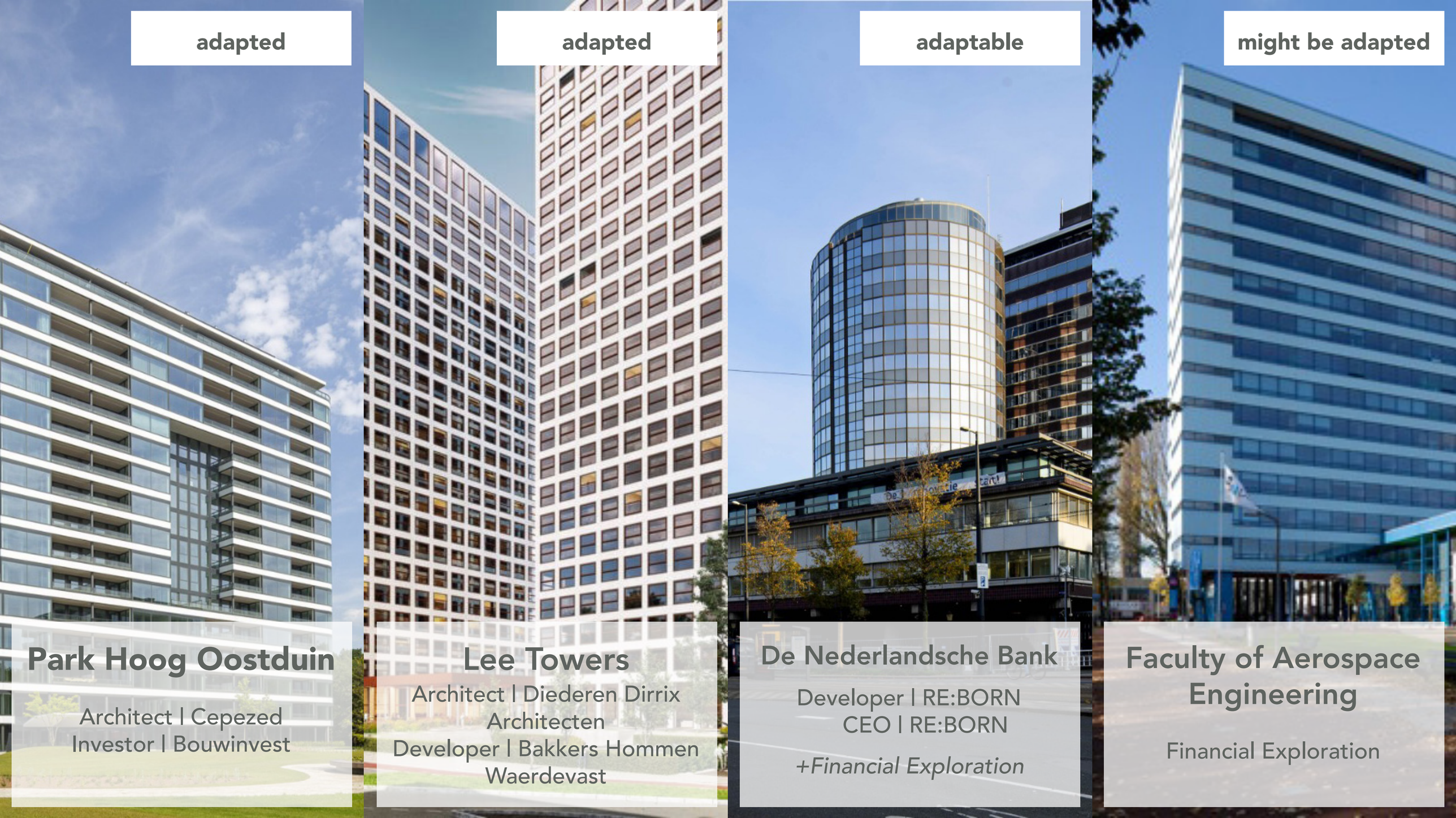
  office > residential

- **Typology**

  central core or horizontal corridor

Method


Case studies
Long-term business case
1
2
Interviews + financial exploration
3
4
Interviews
Synthesis and conditions



adapted

Park Hoog Oostduin

Architect | Cepezed
Investor | Bouwinvest

adapted

Lee Towers

Architect | Diederen Dirrix Architecten
Developer | Bakkers Hommen Waerdevast

adaptable

De Nederlandsche Bank

Developer | RE:BORN
CEO | RE:BORN

+Financial Exploration

might be adapted

Faculty of Aerospace Engineering

Financial Exploration

Long-term business case

- **Interviews**
  - > Senior manager | Brink
  - > Partner | Alba Concepts
  - > Asset manager | TU Delft CRE

Case study findings

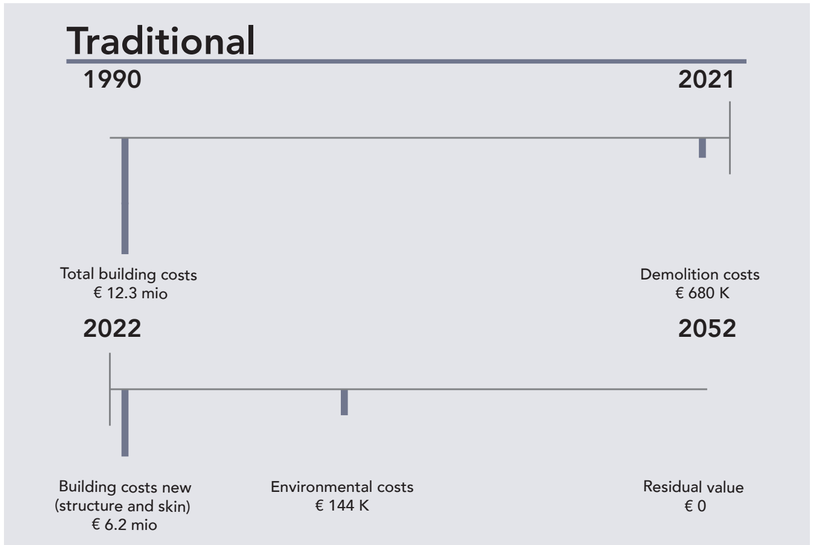
Most important lessons learnt

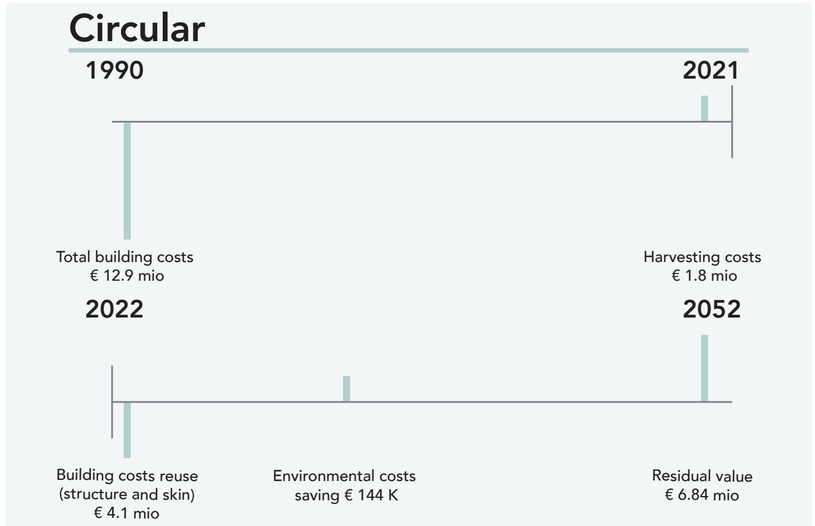
- Residential function: focus on adaptability less relevant, but flexibility remains important.
- Existing volume on specific location very valuable; benefits related to process and nuisance.
- More efforts in beginning of the design process.
- Lower material costs with reuse of elements, however also additional cost items such as storage and refurbishment costs.
- Besides different lifespans per layer, also difference in lifespan per function and the degree of usage.
- With demounting a building, risks can be decreased by early agreements on a location where it will be remounted.
- Lifespan of 30 years currently mainly used. Literature mentioned an average lifespan of 50 years.

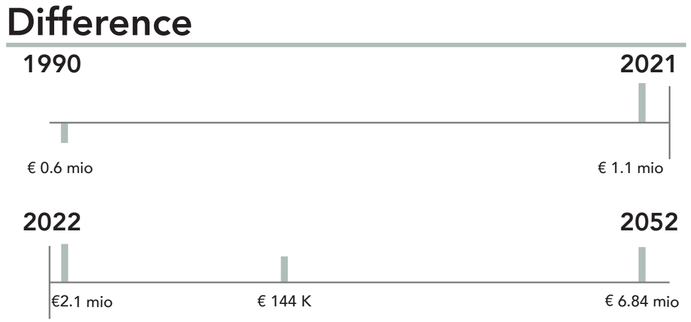
Case study findings

Financial exploration

Traditional (take-make-dispose) vs. Circular scenario







Difference in cash-flows 2022: € 329.630
Difference in cash-flows 2052: € 7.310.560

- By building more adaptable, value in the long term is expected to be higher.
- Harvesting costs > demolition costs. This could change in the future with increasing efficiency in process.
- Residual value on material level almost negligible. Value must be safeguarded on element level.

Case study

Cross-case comparison

Quantitative comparison

Technical features from literature compared.

Lee Towers as most adaptable.

Transformed cases as verification of the literature.

		Points	Lee Towers	Park Hoog Oostduin	De Nederlandsche Bank	Faculty of Aerospace Engineering
City	Multifunctional area = Randstad	1	1	1	1	1
	Inner city location	1	1		1	
Building typology	Central core	1	1		1	
	Horizontal corridor	1		1		1
CapEx and OpEx lie with the same entity	Yes	1	1		1	1
	No	0		0		
Wide floor slabs	Yes	1	1		1	
	No	0		0		0
Grid measurement	1.8 m	1	1			
	Other	0			0	0
Span core to facade	5.4 m - 7.2 m - 9.0 m	1	1			
	Other	0		0	0	0
Floor-to-floor height	> 3.6 m	1	1		1	
	< 3.6 m	0		0		0
Demountable facade	Demountable per component	2		2		
	Stacked	1	1		1	
	Not demountable	0				0
Distinction long- and short-cyclical	Yes	1	1	1	1	1
	No	0				
Services around or in core	Yes	1	1	1	1	0.5
	No	0				
Total points			**11**	**7**	**9**	**4.5**

Research method

1. Collect.
2. Validate.
3. Implement.

Conditions

IV. Synthesis

Synthesis

Technical

Sub-question 1: *What features have to be incorporated in order for a tall building to be adaptable?*

Technical features for an adaptable tall building.

Table of adaptable features

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	Grid measurement of 1,8 m preferred.
	Small span core to facade; 5,4 m - 7,2 m - 9,0 m.
	Floor-to-floor height 3,6 m.
	Possible for horizontal floor extensions.
	Design the structure as flexible, not adaptable or remountable.
	Keep core generic, by including only the essentials and excluding function-specific facilities from the core.
Skin	Design the facade as demountable and adaptable.
	Keep distinction between long-cyclical and short-cyclical facade.
	Make distinction most subjectable to change and least subjectable to change.
Services	Locate services around or in the core.
	Never integrate services with structure.

Synthesis

Process

- **Incorporate adaptability already in the design phase.** Be aware of the value that materials and elements can have in the long-term, and base design decisions hereupon.

- **Establish circular ambitions and requirements as a client** at the beginning of the process, to be able to steer on sustainable design choices in a long-term perspective.

- **Incorporate checks and balances along the process,** so that the performance level, quality level and therefore its future value are guaranteed.

Synthesis

Broader field

- **Stimulate both the demand side and the supply side** to redesign and rethink their products.
- **Create a database, market place or platform** for the exchange of harvested materials.
- A change in the fiscal system is needed; for example a shift in taxes from labor to ‘virgin’ materials and pollution.
- **A wider implementation of material passports**, for recording the value of materials over time, how it is constructed and where it originates.
- **Tools and labels should be used as steering instruments upfront,** and not as assessment instruments afterwards.

Synthesis

Financial

Answer to sub-question 4: *How can the financial model be changed so that adaptability benefits and costs are taken better into consideration?*

Roadmap for improved business case

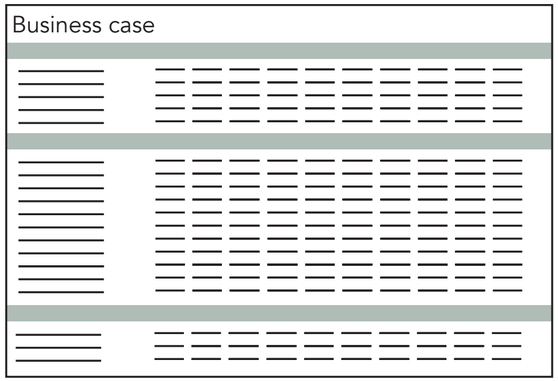
Applicable to all building types, not only tall buildings.

Synthesis

Business case

0. Traditional

A traditional business case has been taken as starting point, since it is believed that the long-term business case should evolve out of the traditional, linear system.



Synthesis

Business case

1. Expand horizon

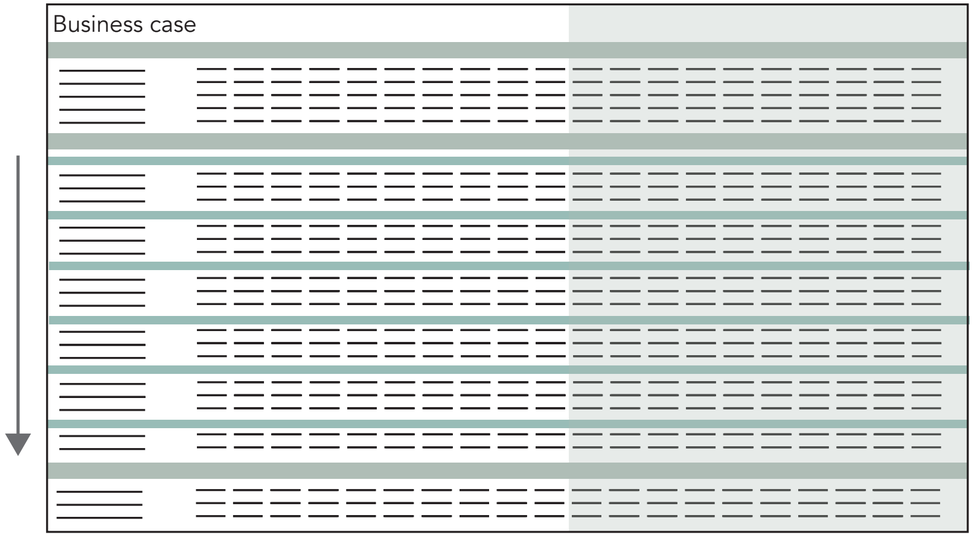
The first step is to extend the horizon beyond the traditional 50 years. This enforces long-term thinking and stimulates a different perspective on decision-making.

Synthesis

Business case

2. Separation by layers

Distinguish the model by separate layers, for example by Brand's Site, Structure, Skin, Services, Spaceplan and Stuff.

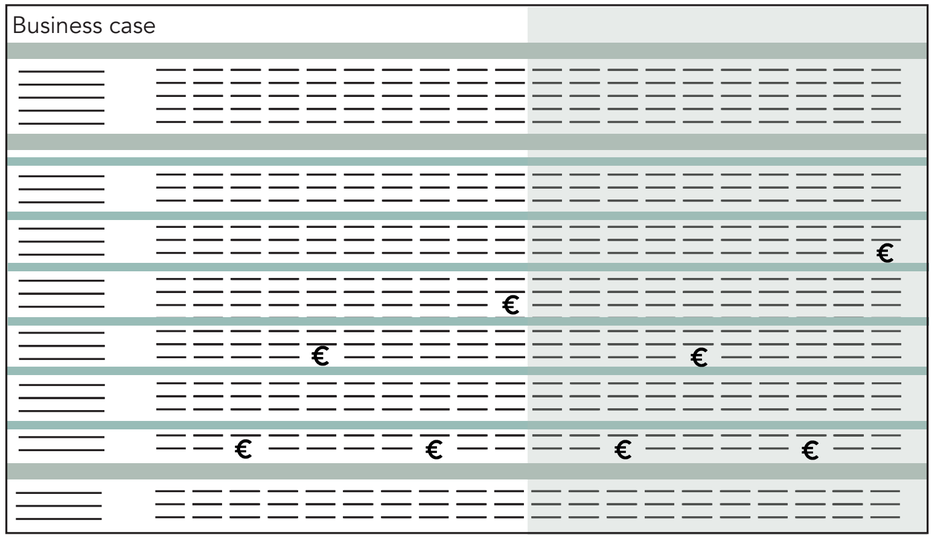


Synthesis

Business case

3. Include residual values

Allocate residual values on each layer after the end of its lifespan. In a circular economy it is assumed that resources and materials always have a value.

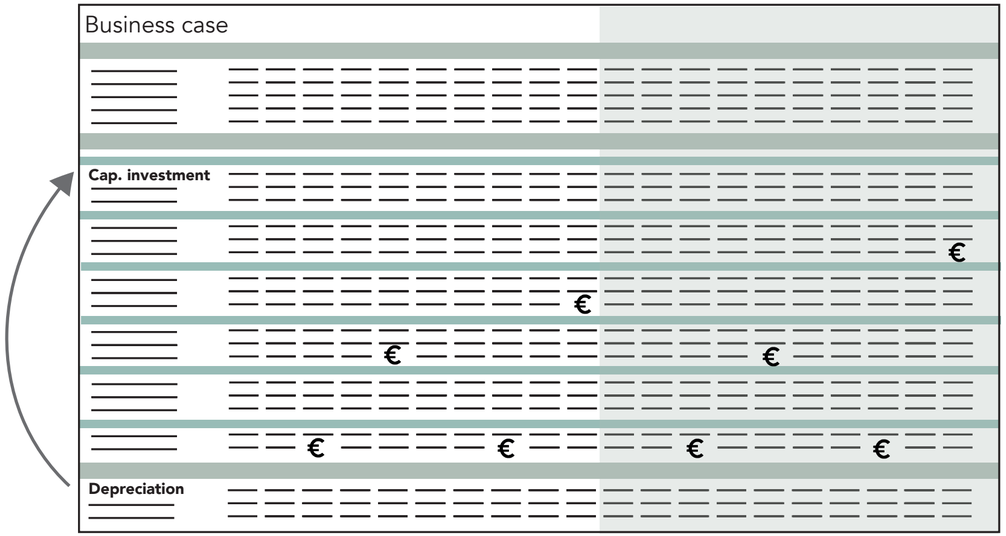


Synthesis

Business case

4. Adjust depreciation method

By including a residual value, the depreciation method can be adjusted by depreciating the cost price minus that residual value. This leads to lower depreciations, which unlocks money that can be reinvested.

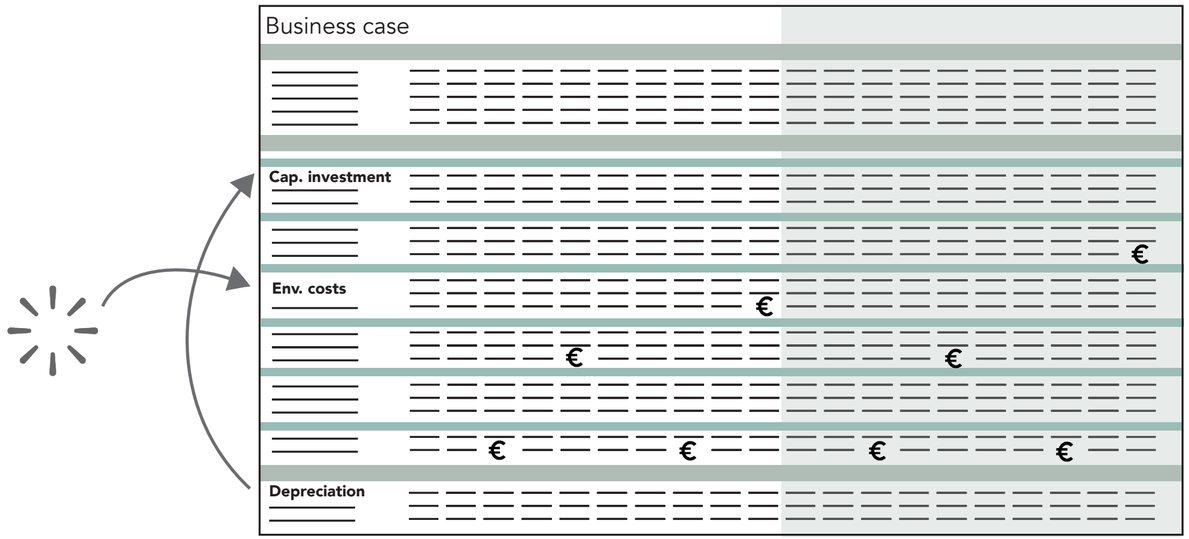


Synthesis

Business case

5. Include environmental costs

Environmental costs should be included in the business case for an integral and realistic assessment wherein the potential of adaptability is better visible. The existing tool of MPG can be used for this.

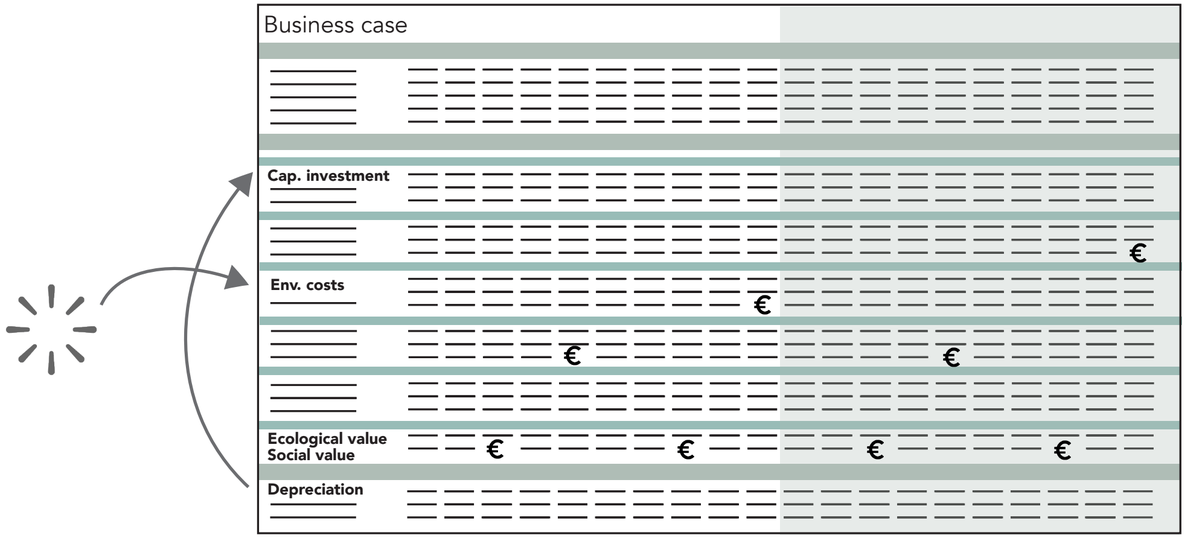


Synthesis

Business case

6. Include social and ecological value

For a comprehensive approach, the social and ecological value created by the building should also be taken into consideration. Here, value can be regarded as impact being made and quantified into euros.

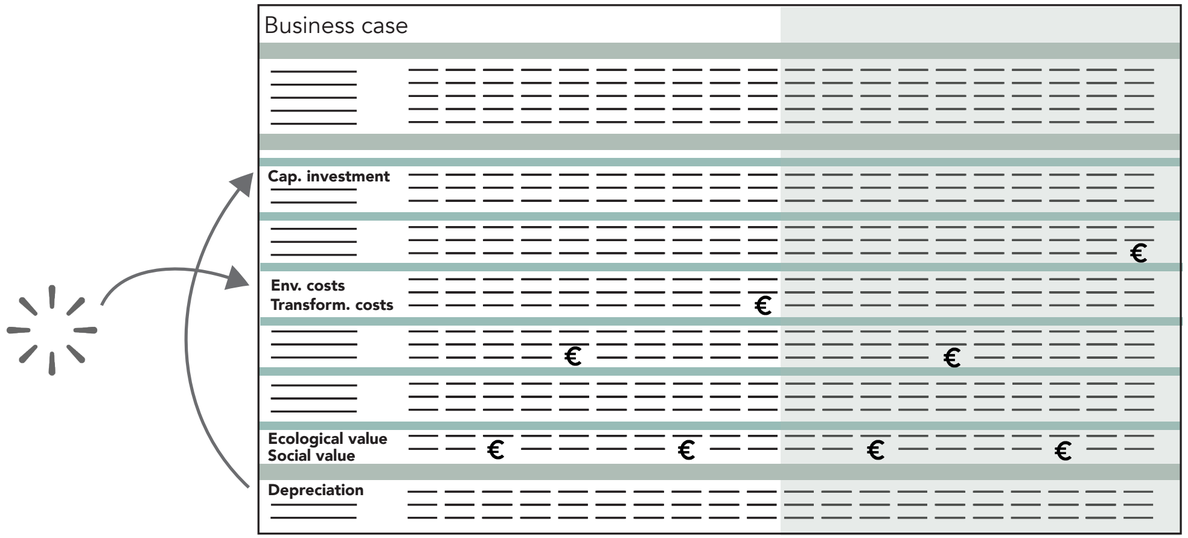


Synthesis

Business case

7. Include transformation costs

Traditionally, replacement costs are included, often for renovations. However, with adaptability, transformation costs are a new cost item that replaces the renovation costs.

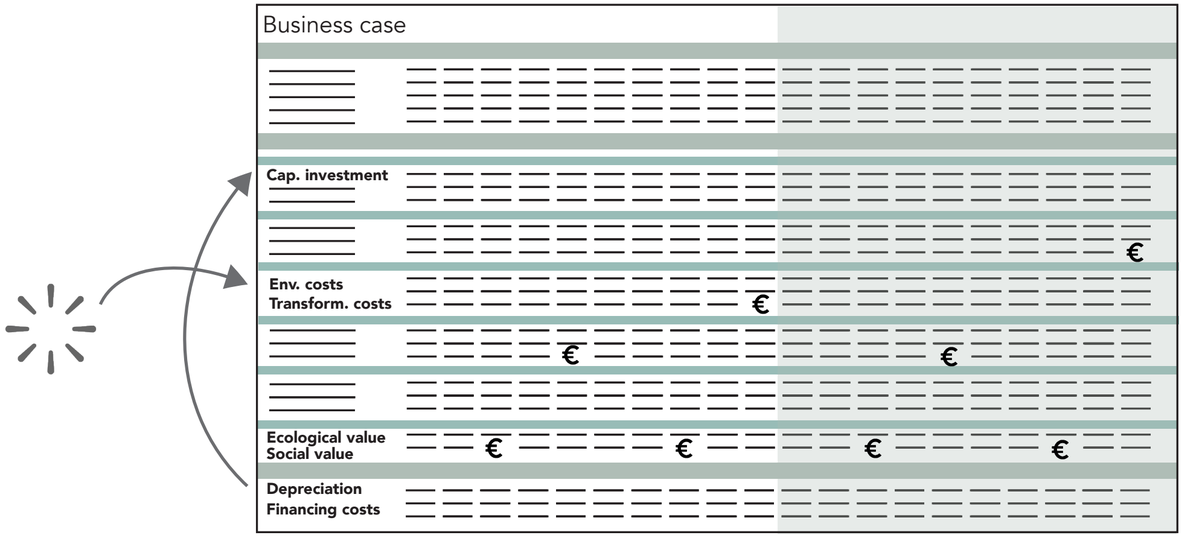


Synthesis

Business case

8. Adjust financing approach

A lower interest rate can be used since an adaptable building has a lower risk profile because of its adaptive capacity. This does not influence the model itself, but rather the approach and for comprehensiveness it is included.



V. Conclusion

Conclusion

Research question

"What business model and financial model are most appropriate for real estate organizations to achieve increased adaptability in tall buildings?"

Business model:

- For each layer, a different business model could be applicable
- Resource Recovery and Product Life Extension as useful business models for adaptability.
- No contributions from case study, no circular business models used.

Financial model:

- Traditional model is still the most appropriate basis, but is in desperate need of alterations, as elaborated in the roadmap.
- Lack of knowledge on development of value over time.

Conclusion

Discussion & limitations

Demarcation of tall buildings (vs. smaller buildings)

Importance of demountability

Adaptability new developments vs. existing real estate

Different levels of quality per case.
- Different perspectives of interviews.
- Different types of data retrievable.
- More information on soft values than financial/hard values.
- Different phases over time.

Reliability

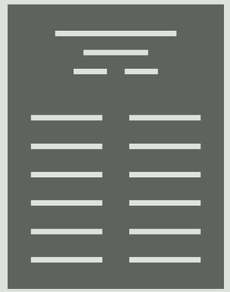
Research focused on:
- Tall buildings
- Two typologies
- Dutch cases

Interviews are based on personal views of experts.

Comparability low because of different interview protocols.

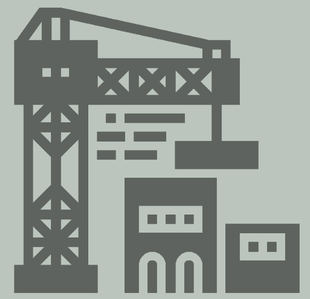
Conclusion

Recommendations



Scientific recommendations

- Increase evidence on lifespan estimation.
- Increase research on perspective of user: adaptability and its benefits.
- Increase knowledge on the value of demountability and the interrelations of demountability and adaptability.
- Conduct quantitative research on the business case in retrospect.
- Conduct similar studies with other typologies and functions.



Practical recommendations

- Do not wait for others, but explore yourself.
- Join forces cross-disciplinary.
- Invest in data gathering and processing.
- Consider the vital role of clients.
- Consider the accelerating role of the government.
- Steer upfront instead of measure afterwards.

Adaptable Real Estate

The added value of adaptability in a long-term business case

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Questions?