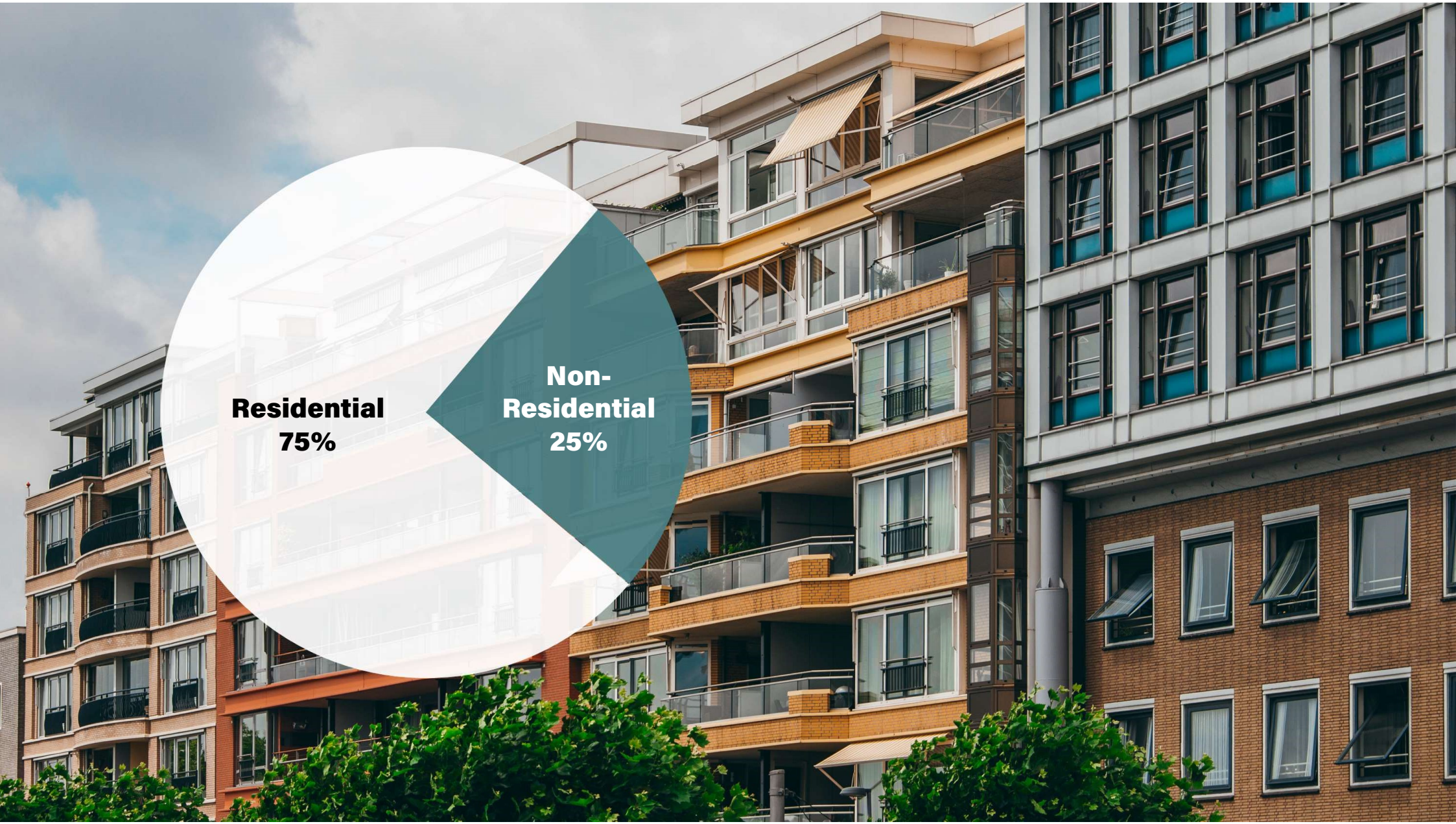

Buildings are responsible for 36% of the global energy consumption and 27% of the total CO2 emissions
(UN, 2021)


Residential
75%
Non-
Residential
25%

Retail relevance

- Highest floor Surface area of the EU non-residential building stock
- Highest energy use of the EU non-residential building stock

Shopping centres potential

- One of the highest energy demands for non-residential buildings
- Part of a mature market that needs to be renovated
- Already holds a high retrofit rate compared to housing – 4%

26%

Retail buildings
energy Label C or above

(Colliers, 2021)

P5 Presentation

Energy transition in the retail sector

Revealing decision-making behaviours for Energy Efficiency Retrofits (EER) of shopping centres

Maria Fernanda Villalba Muñoz
MSc Management in the Built Environment 2022-2023 | TU Delft

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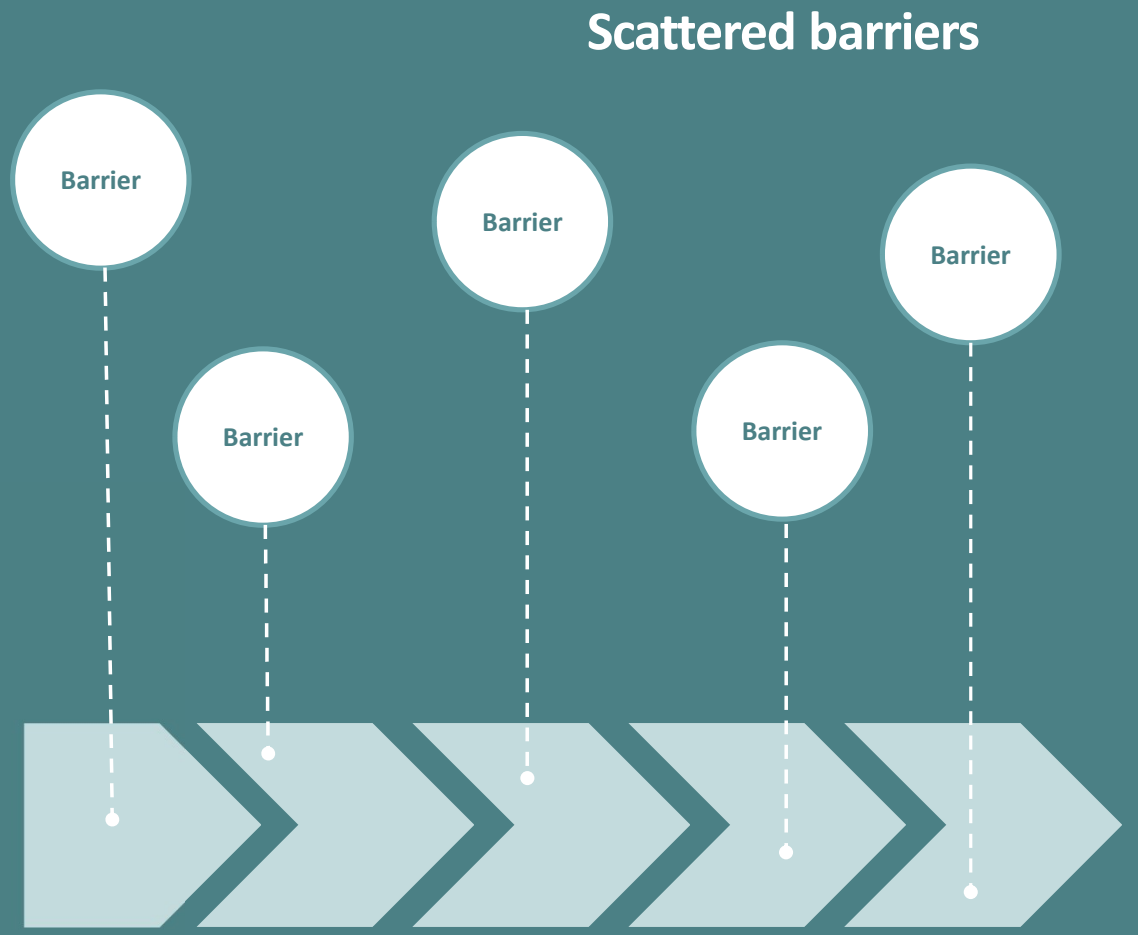
Research Aim



- Map the process for shopping centres
- Reveal stakeholders' behaviours

01

RESEARCH QUESTION

How can owners support a better decision-making process to steer EERs of shopping centres?

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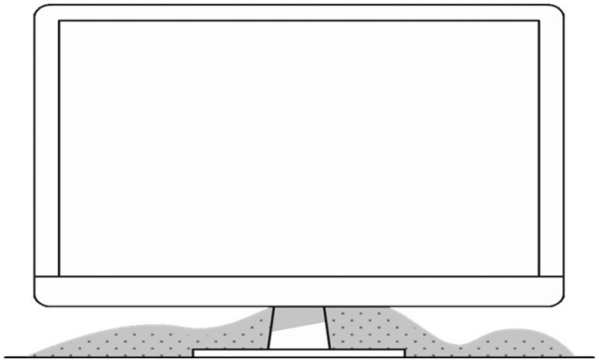
SUB-QUESTIONS

[SQ1]: What is the **state-of-the-art** of energy efficiency retrofit of shopping centres?

[SQ2]: How is the **EERs' decision-making process** of shopping centres taking place?

[SQ3]: What are the **barriers** encountered during the decision-making process of EERs of shopping centres?

Methods



Theoretical research

Literature review

Database consultation

Empirical research

Multi-case study

Expert interview

01

Theoretical research

Literature review

02

Case study Selection criteria

What?

- Characteristics of shopping centres in the Netherlands
- Operation
- Preferred retrofit measures

Theoretical framework

Who?

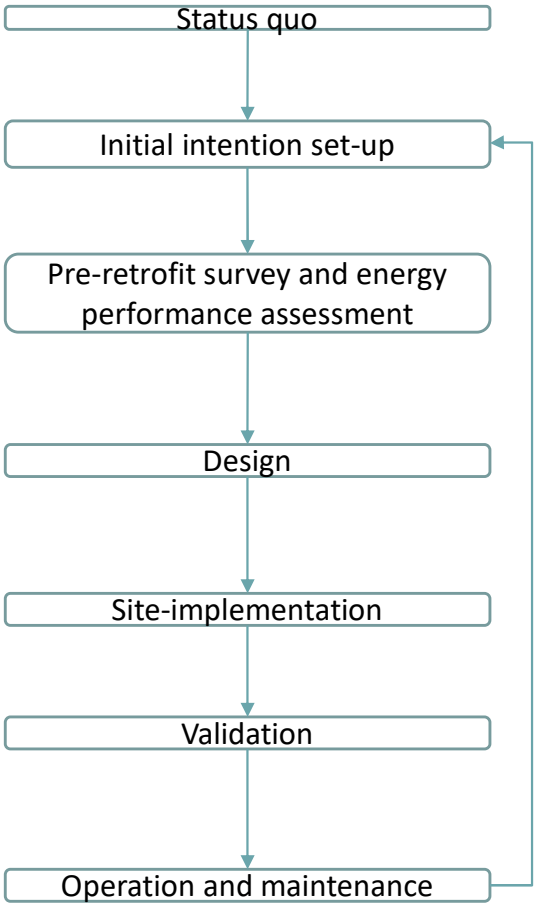
- Stakeholders involved

How?

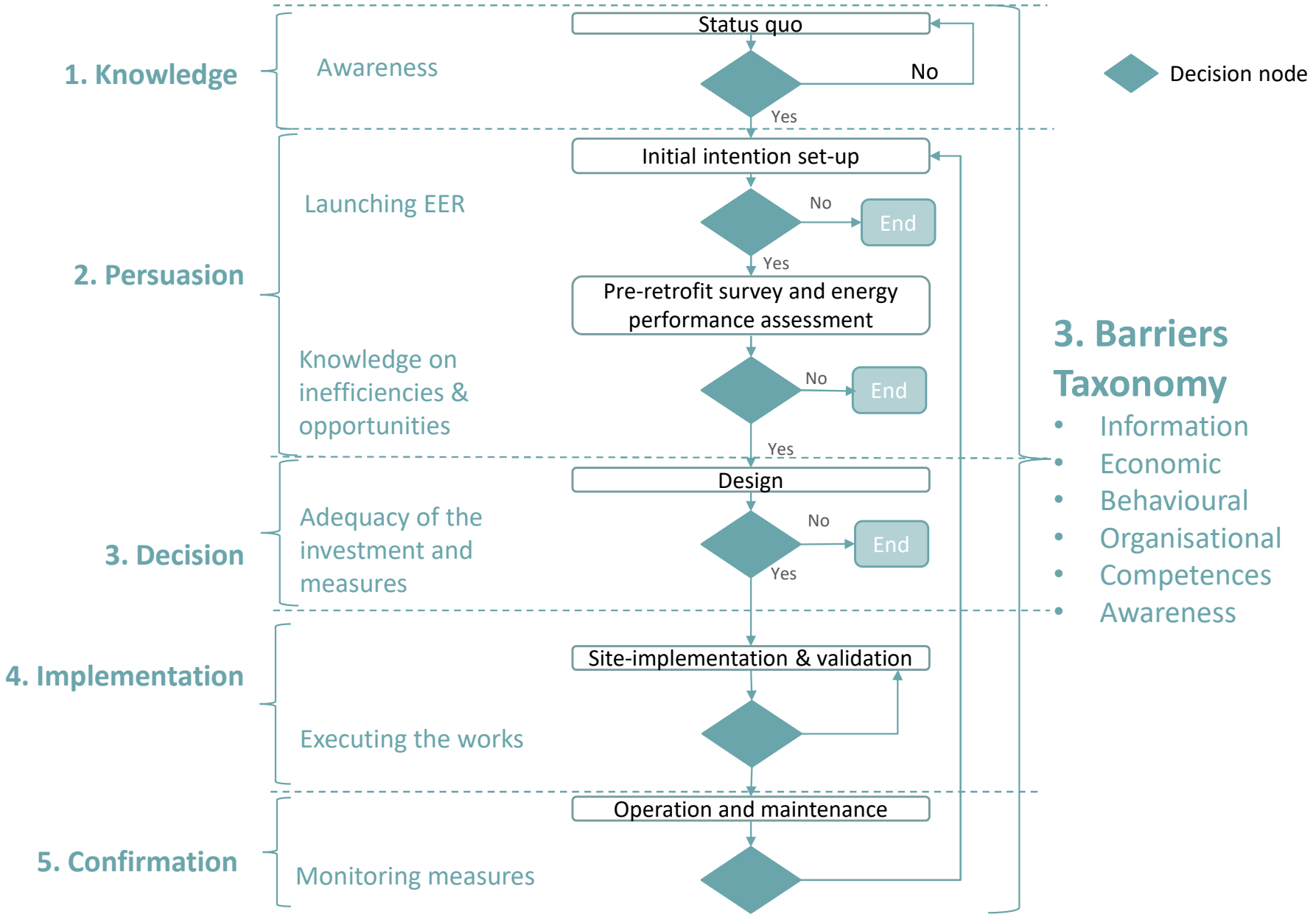
- EER decision-making process
- Stakeholders' behaviours

Theoretical research

Theoretical framework



1. Energy Efficiency Retrofit (EER) Process


1. Knowledge
Awareness
Status quo
No
Yes
Decision node
2. Persuasion
Launching EER
Initial intention set-up
No
End
Yes
Pre-retrofit survey and energy performance assessment
Knowledge on inefficiencies & opportunities
No
End
Yes
3. Barriers Taxonomy
Information
Economic
Behavioural
Organisational
Competences
Awareness
3. Decision
Adequacy of the investment and measures
Design
No
End
Yes
4. Implementation
Site-implementation & validation
Executing the works
5. Confirmation
Operation and maintenance
Monitoring measures

Empirical research

CASE STUDIES

03

SELECTION CRITERIA

- Gone through EER process
- Covered category
- 5,000 smq > size < 70,000sqm
- Built before 1990
- At least 1 supermarket
- Different ownership types
- Different EER measures

CASE A: De Tuinen

Size: Small category
Ownership: Single- Large (REI)
EE stage:
- R1: 4-Implementation
- R2: 2-Persuasion

EER driver: Low (maintenance and component level measures)

CASE B: Zuidplein

Size: Large category
Ownership: Fragmented
EE stage:
- R1: 4-Implementation
- R2: 4-Implementation

EER driver: Medium (component and deep level measures)

CASE C: Het Stroink

Size: Small category
Ownership: Single – Small (REI)
EE stage: 5- Confirmation
EER driver: High (Deep level measures)

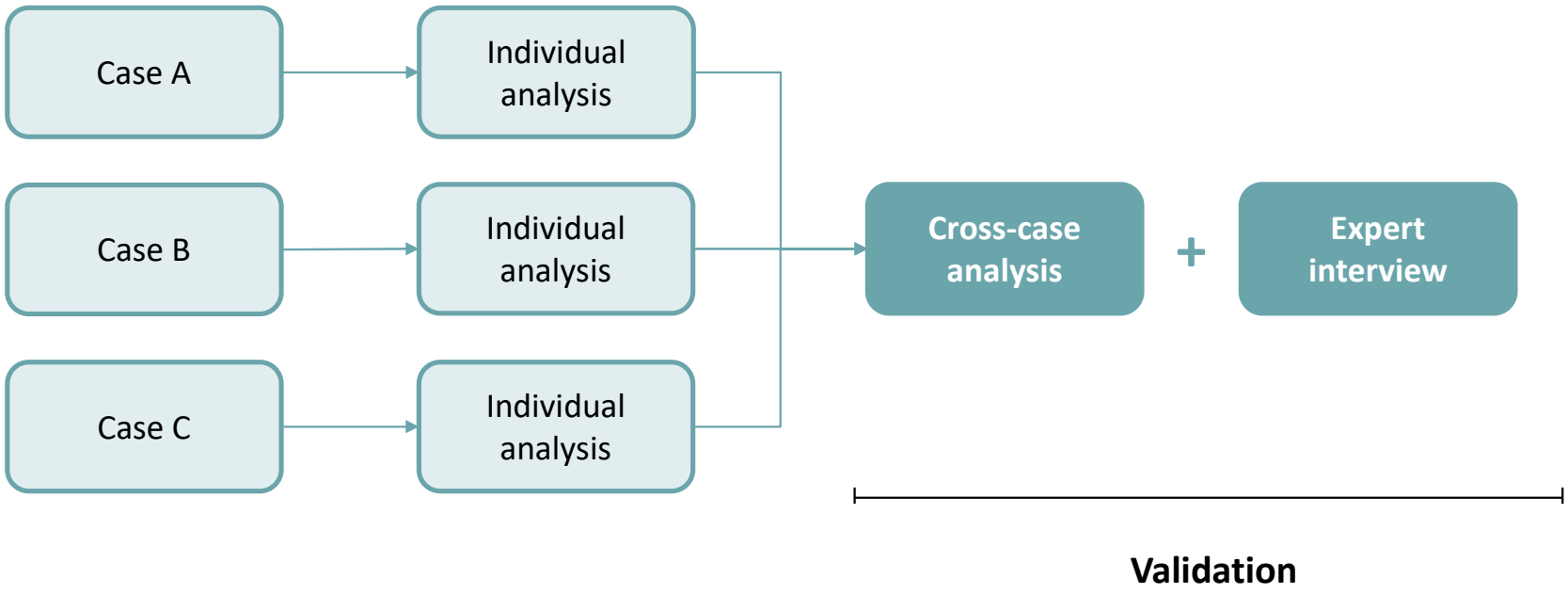
Data collection

- Case study documents
- 14 interviewees from cases + 1 Expert interview
- Interviewee profile:

CASE STUDIES– GENERIC ACTORS LIST	
Interview	**Role**
1	Owner/Fund manager
2	Property management
3	Owner association manager
4	Retrofit project manager
5	Tenant (non-food retailer)
6	Tenant (Food retailer)

- Expert interview: Owner – Large REI

Method of analysis



Discussion

ANALYSIS OF THE FINDINGS

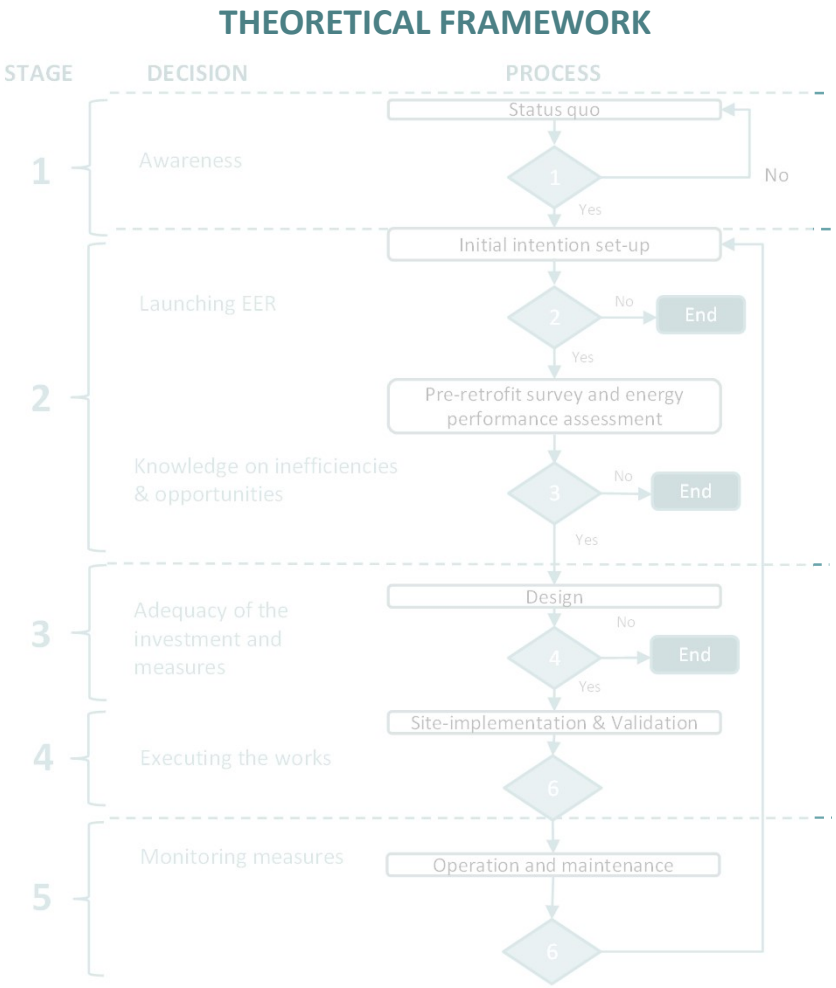
A. EERs decision-making process

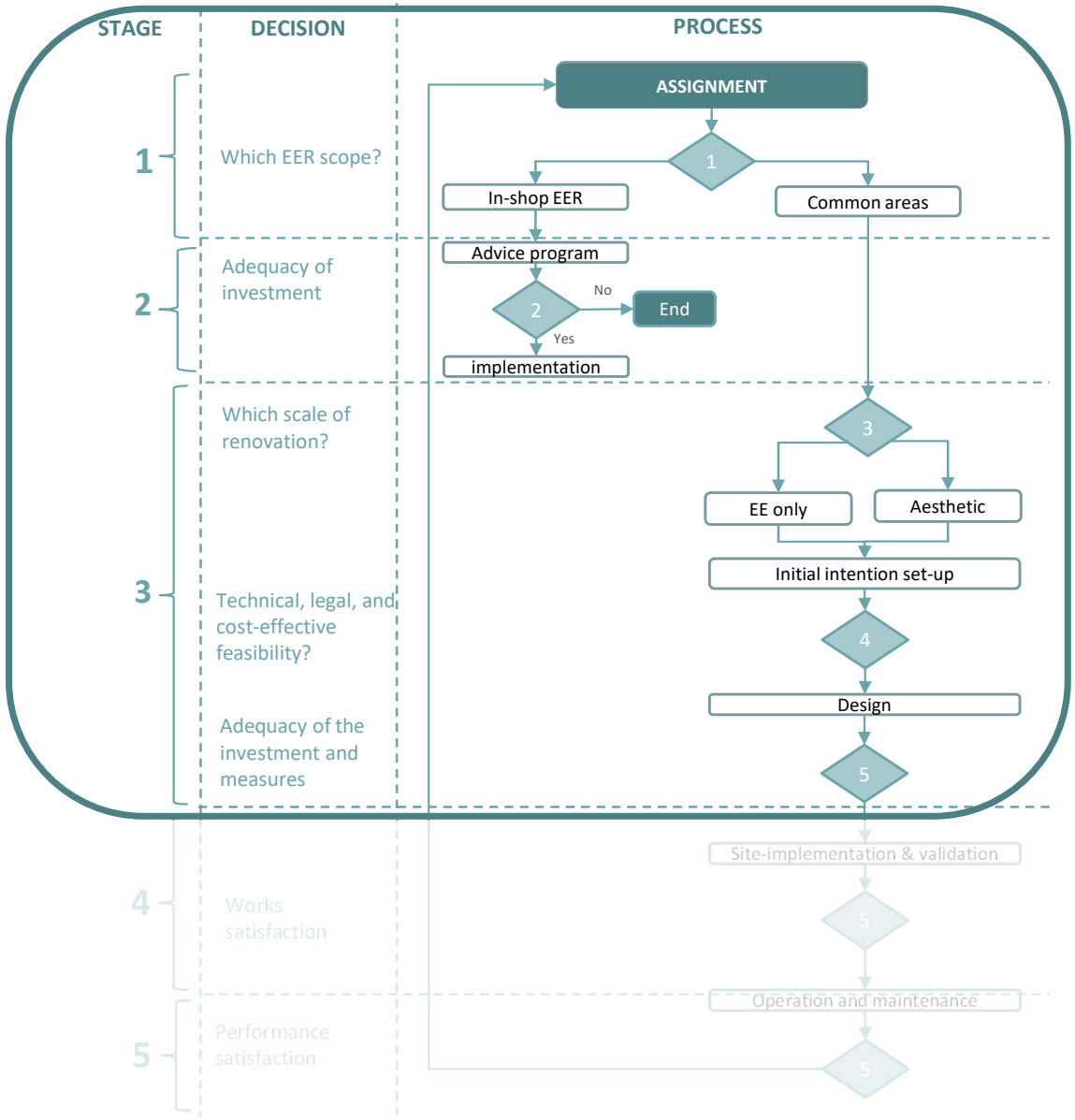
B. Barriers in the EERs decision-making process

C. Influence of the governance system

D. D. Scale VS. Energy Efficiency measure packages

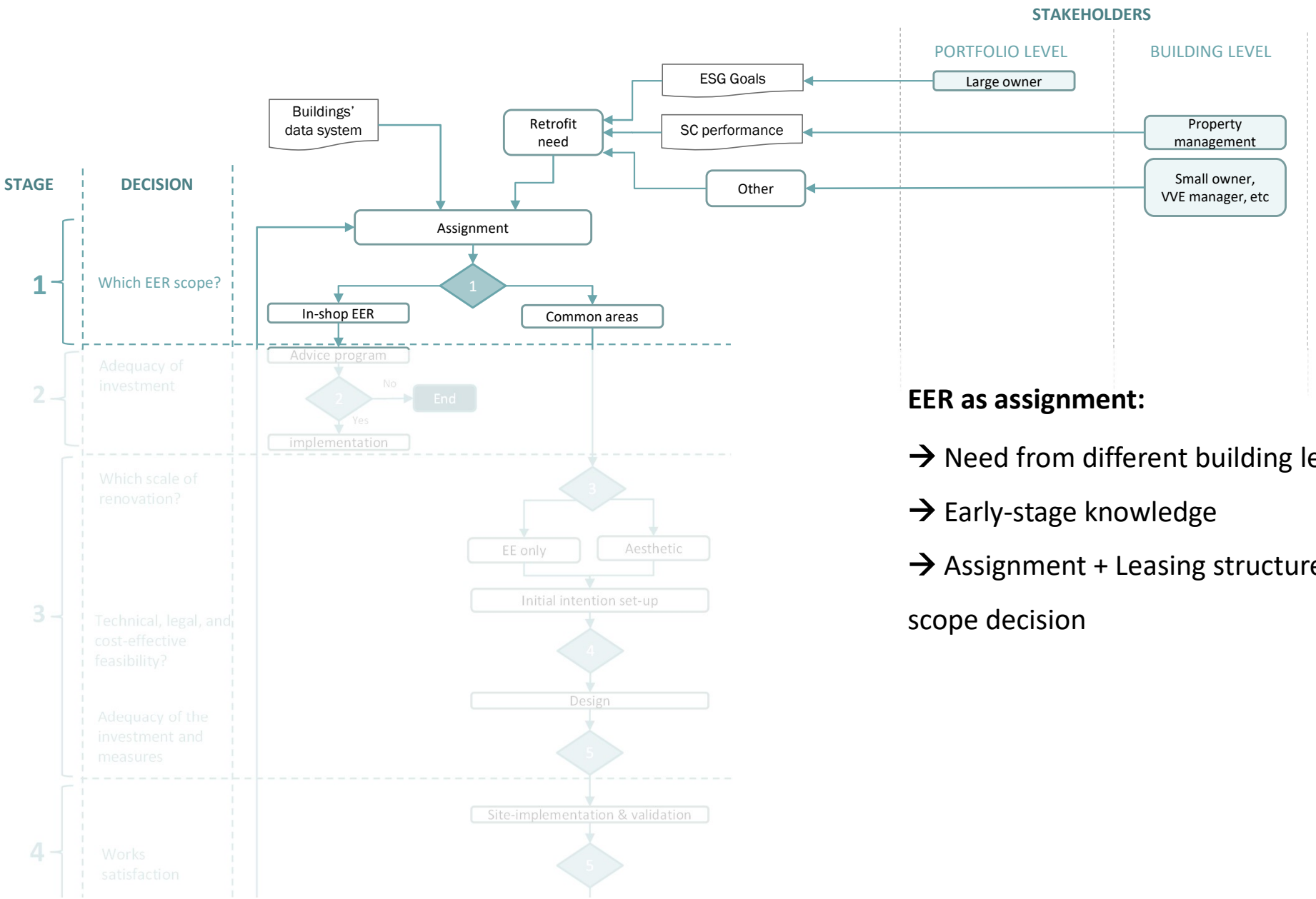
04





Discussion

A. EERs decision-making process

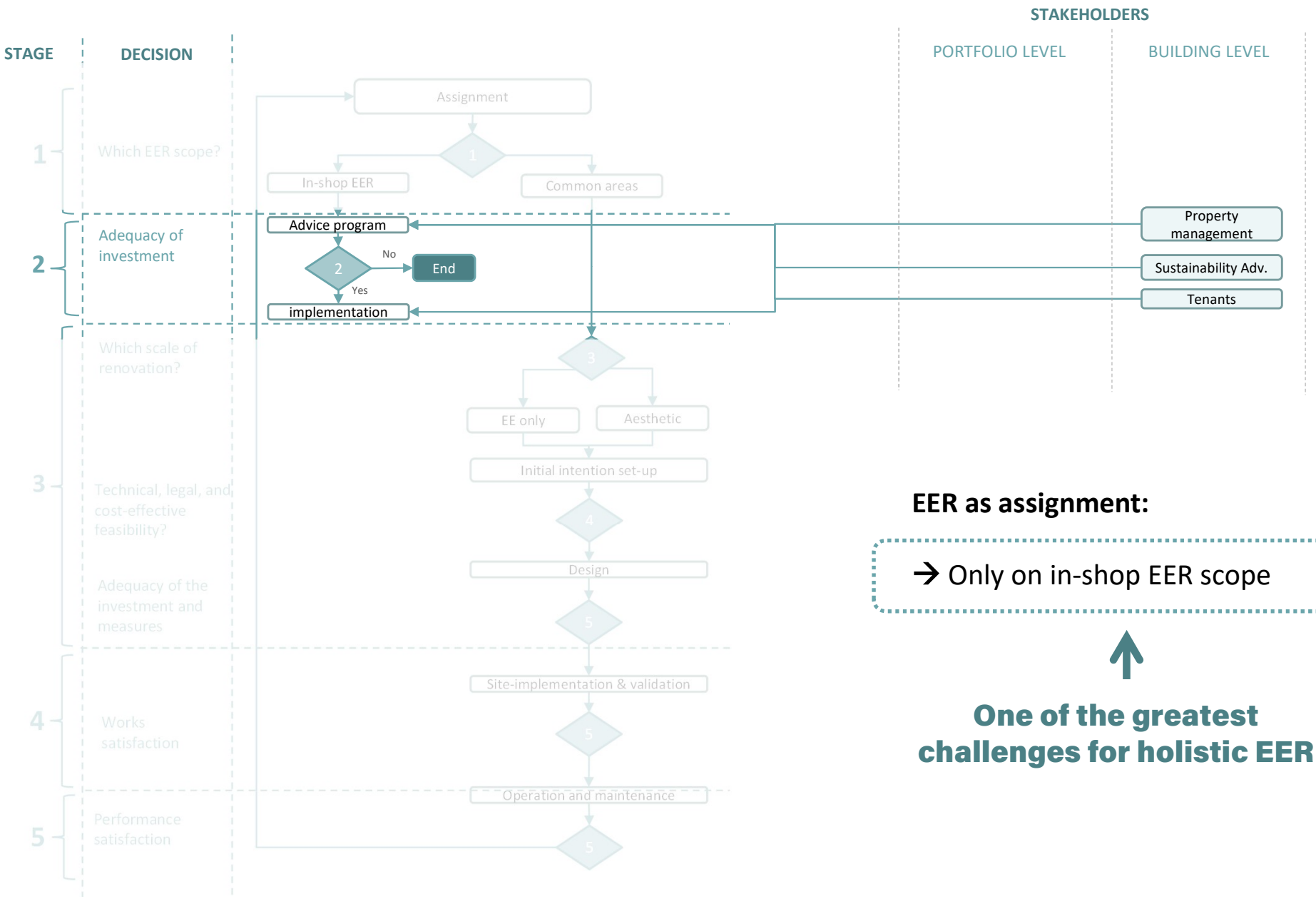


EER as assignment:

→ Need from different building levels

→ Early-stage knowledge

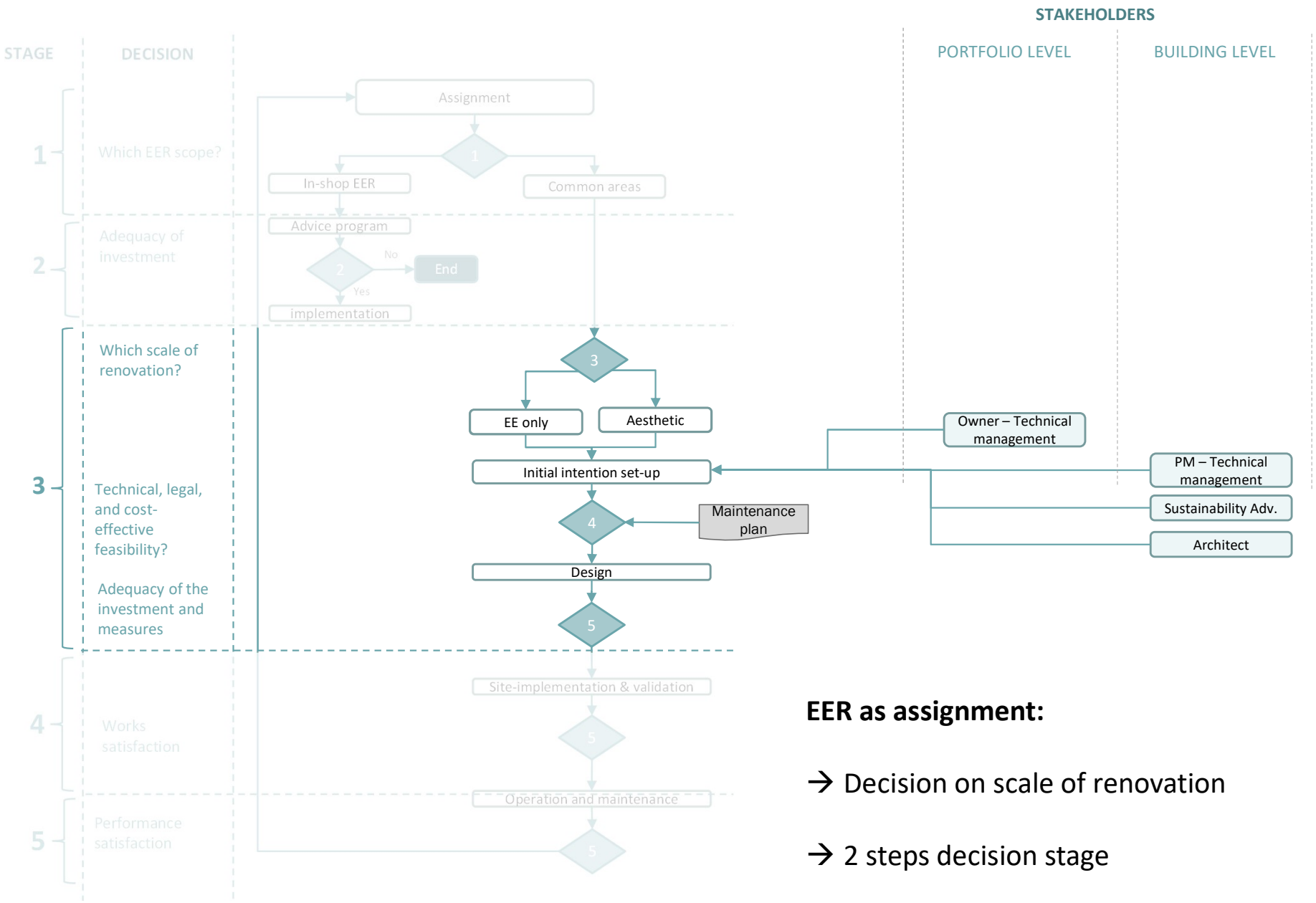
→ Assignment + Leasing structure = scope decision



EER as assignment:

→ Only on in-shop EER scope

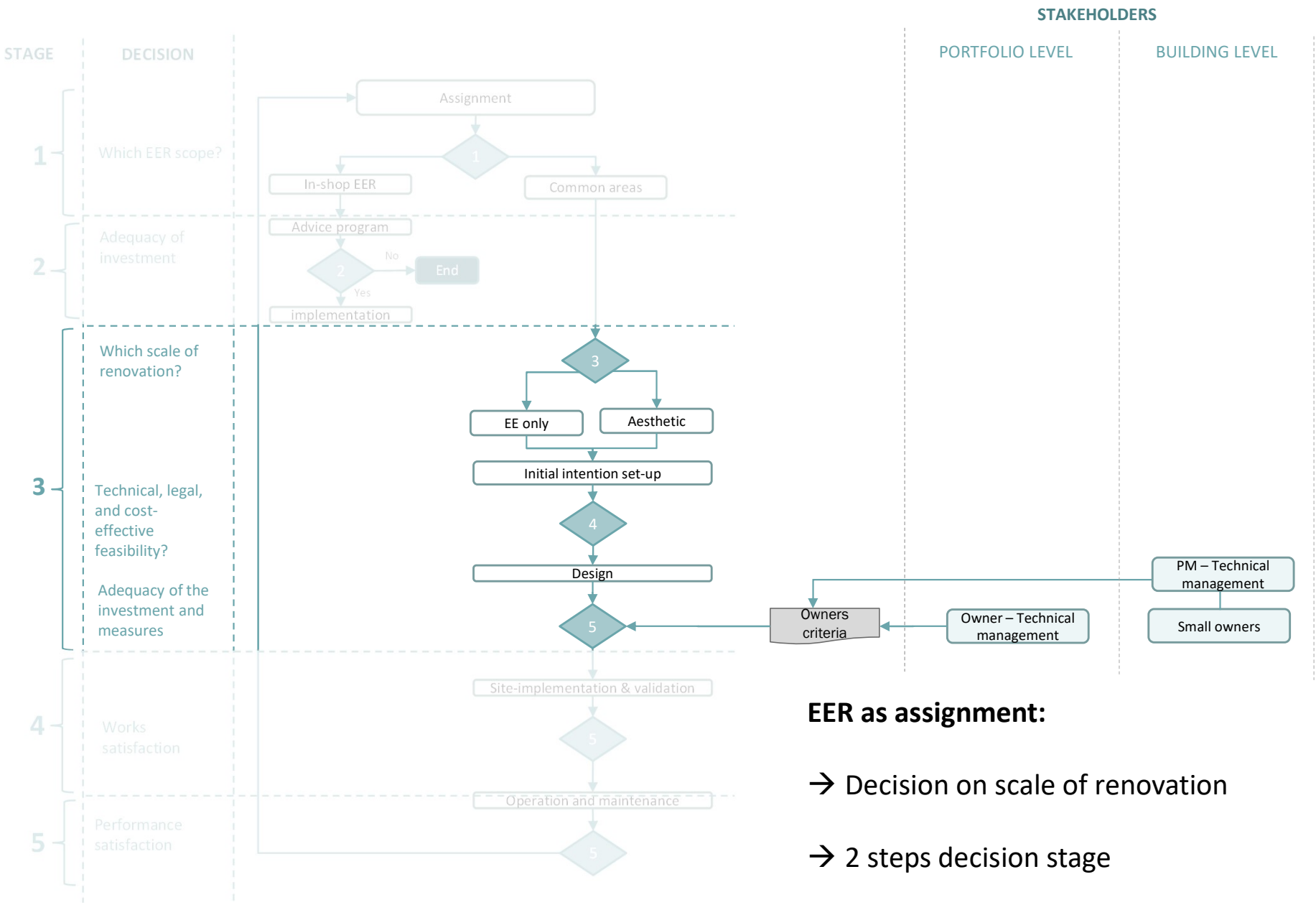
One of the greatest challenges for holistic EER



EER as assignment:

→ Decision on scale of renovation

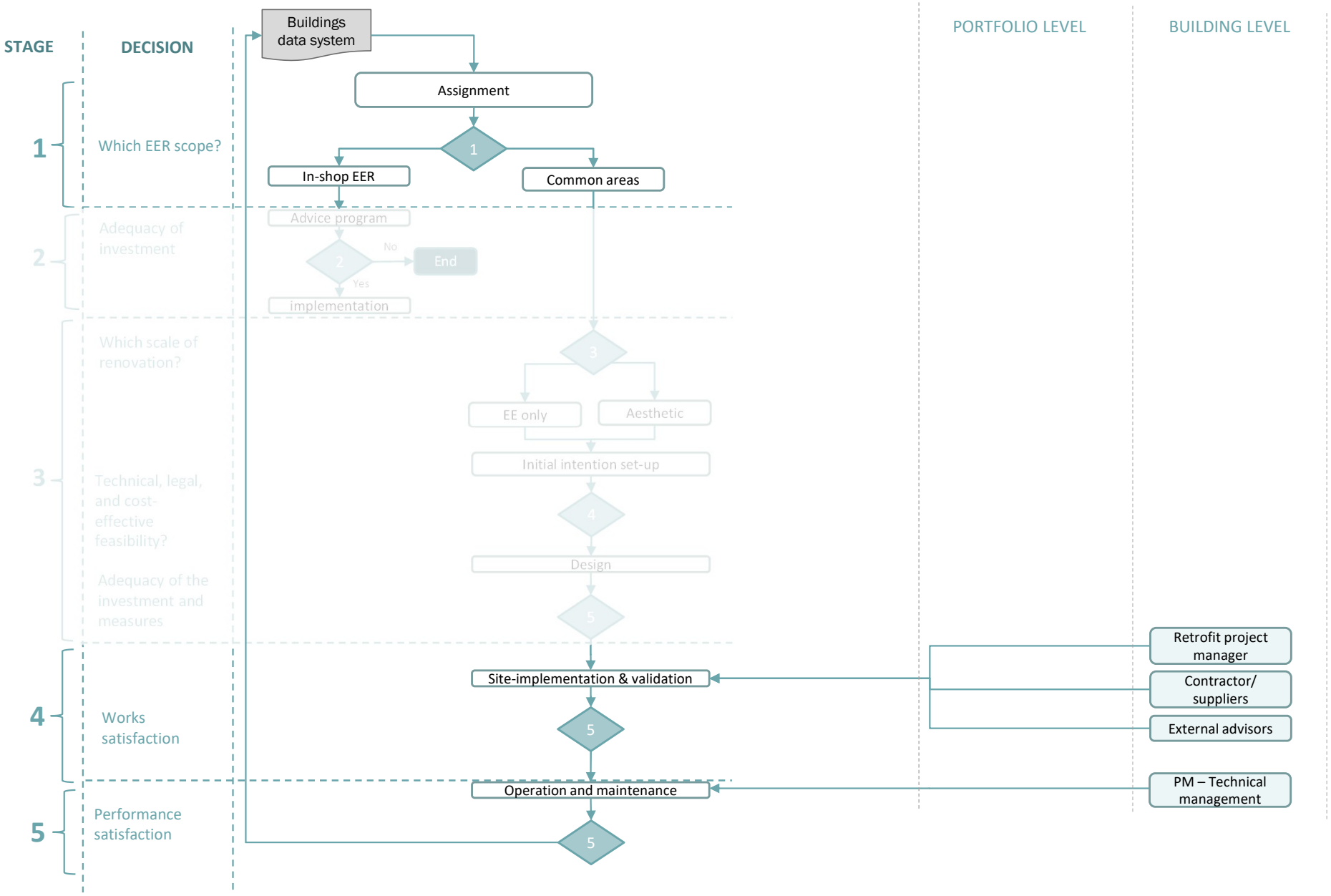
→ 2 steps decision stage



EER as assignment:

→ Decision on scale of renovation

→ 2 steps decision stage


STAGE
DECISION
PORTFOLIO LEVEL
BUILDING LEVEL
Buildings data system
Assignment
1
Which EER scope?
In-shop EER
Common areas
Advice program
2
Adequacy of investment
No
End
Yes
implementation
Which scale of renovation?
3
EE only
Aesthetic
Initial intention set-up
4
Design
Technical, legal, and cost-effective feasibility?
Adequacy of the investment and measures
5
Site-implementation & validation
Works satisfaction
5
Operation and maintenance
Performance satisfaction
5
Retrofit project manager
Contractor/ suppliers
External advisors
PM – Technical management

Discussion

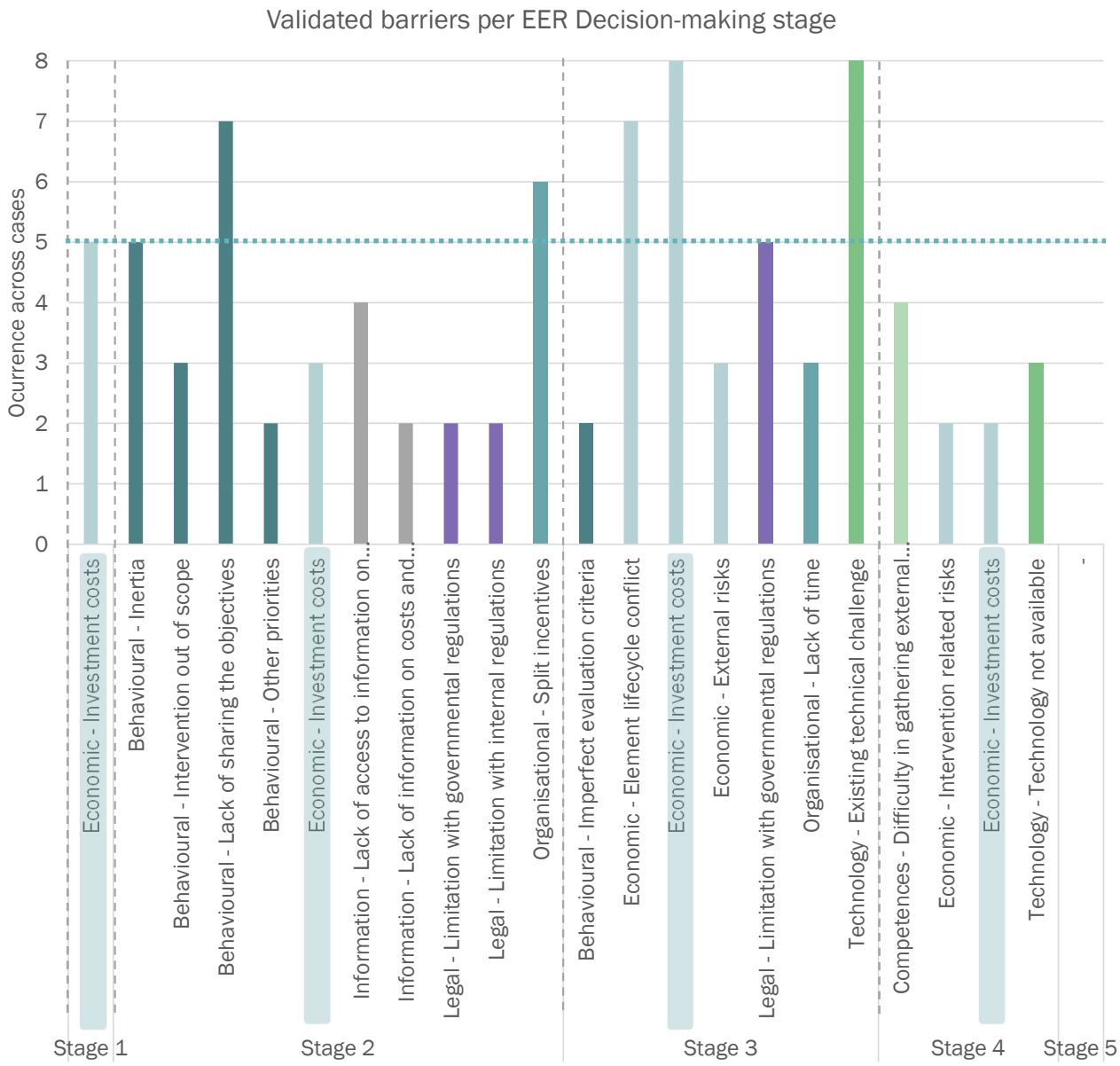
B. Barriers in the EERs decision-making process

Validated barriers

• Technology: Technology not available	
• Technology: Existing technical challenge	New Barrier
• Organisational: Split incentives	
• Organisational: Lack of time	
• Legal: Limitation with internal regulations	
• Legal: Limitation with governmental regulations	
• Information: Lack of information on costs and benefits	
• Information: Lack of access to information of energy consumption	New Barrier
• Economic: Investment costs	
• Economic: Intervention-related risks	
• Economic: External risks	
• Economic: Element lifecycle conflict	New Barrier
• Competences: Difficulty in gathering external competences	
• Behavioural: Other priorities	
• Behavioural: Lack of sharing the objectives	
• Behavioural: Intervention out of scope	New Barrier
• Behavioural: Inertia (resistance to change)	
• Behavioural: Imperfect evaluation criteria	
• Awareness	

Key takeaways

- Most barriers occur in stages 2 & 3
- Stage 2: behavioural category
- Stage 3: economic and technology barriers
- Investment costs in all stages



Key takeaways

- Barriers change depending on the stage and the causing and bearing-agent
- Solutions need to be tailored individually
- Distinction between types of tenants → solutions, access to RES

Example:

Barrier	Causing agent	Bearing-agent	Explanation	Existing solution	Responsible
Behavioural - Lack of sharing the objectives	OW, CM	T-L, T-S	ROI vs. climate comfort		
	T-L	OW	Clashing sustainability objectives and strategies		
	T-S	OW	Lack of clear sustainability objectives	Tenant advisory project	OW, PM-CM
	OW-F	VVE	Difficulty in persuading and communicating plans to all types of owners		

Discussion

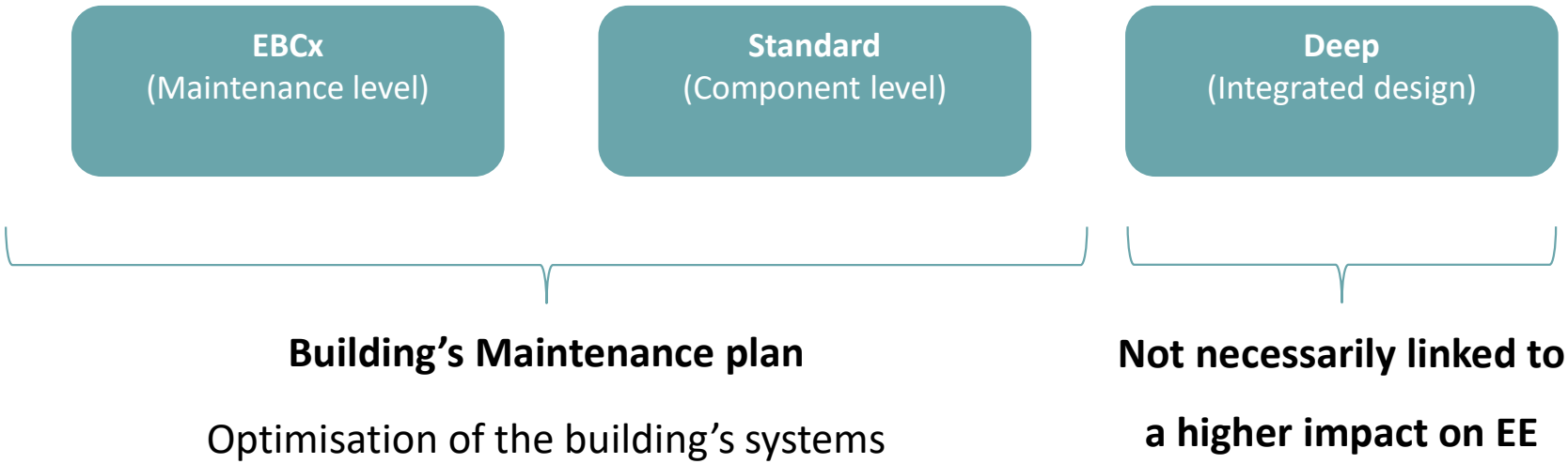
C. Influence of the governance system

Complexity of decision-making

- Literature: number of stakeholders involved
- Findings: in terms of ownership structure
  - Top-down decision-making
  - Respond to larger portfolio goals
  - More stakeholders across assets in the portfolio
  - Duplication of roles

Discussion

D. Scale VS. Energy Efficiency measure packages



Conclusions

How can owners support a better decision-making process to steer EERs of shopping centres?

05

- **[SQ1]:** Identify State-of-the-art of shopping centres in NL
- **[SQ2]:** Map of the EER decision-making process
- **[SQ3]:** Identify the barriers from different stakeholders

JOINT EFFORTS

OWNERS

PROPERTY MANAGERS

POLICY MAKERS

ROLE OF OWNERS

Stage 1

1. Develop a cohesive and integrated sustainability strategy
2. Enhance governance structure
   a) Decentralize decision-making
   b) Foster collaboration across different property management teams
   c) Streamline sustainability advisors
   d) Collaborate with other external and supply-side stakeholders
3. Invest in centralized building data systems

Stage 2

4. Address tenant's unequal access to renewable energy sources
5. Address tenant's barriers individually

Stage 3

Stage 4

Stage 5

6. Exploit property managers' expertise and knowledge in project management, design and construction services
7. Entrust property managers with overseeing user comfort and satisfaction during deep retrofits
8. Encourage end-user engagement towards sustainability

ROLE OF PROPERTY MANAGERS

Stage 1

1. Consult and assist in strategic sustainability strategy development
2. Coordinate with owners on building data collection

Stage 2

3. Exploit existing on-site user relationships

Stage 3

4. Promote project management services

Stage 4

5. Oversee end-user comfort and satisfaction

Stage 5

6. Promote end-user engagement towards sustainability
7. Collaborate with other property management teams

POLICYMAKERS

1. Streamline and integrate existing regulations
2. Extend regulations for small owners and tenants
3. Foster collaboration with supply-side & external stakeholders to reach more ambitious goals

Limitations

1. Limitation of case study design: replicability and comparability.

2. Time and resources constraints

3. Language barrier and lack of interest from some stakeholders

06

Further research

1. Study types of owners separately

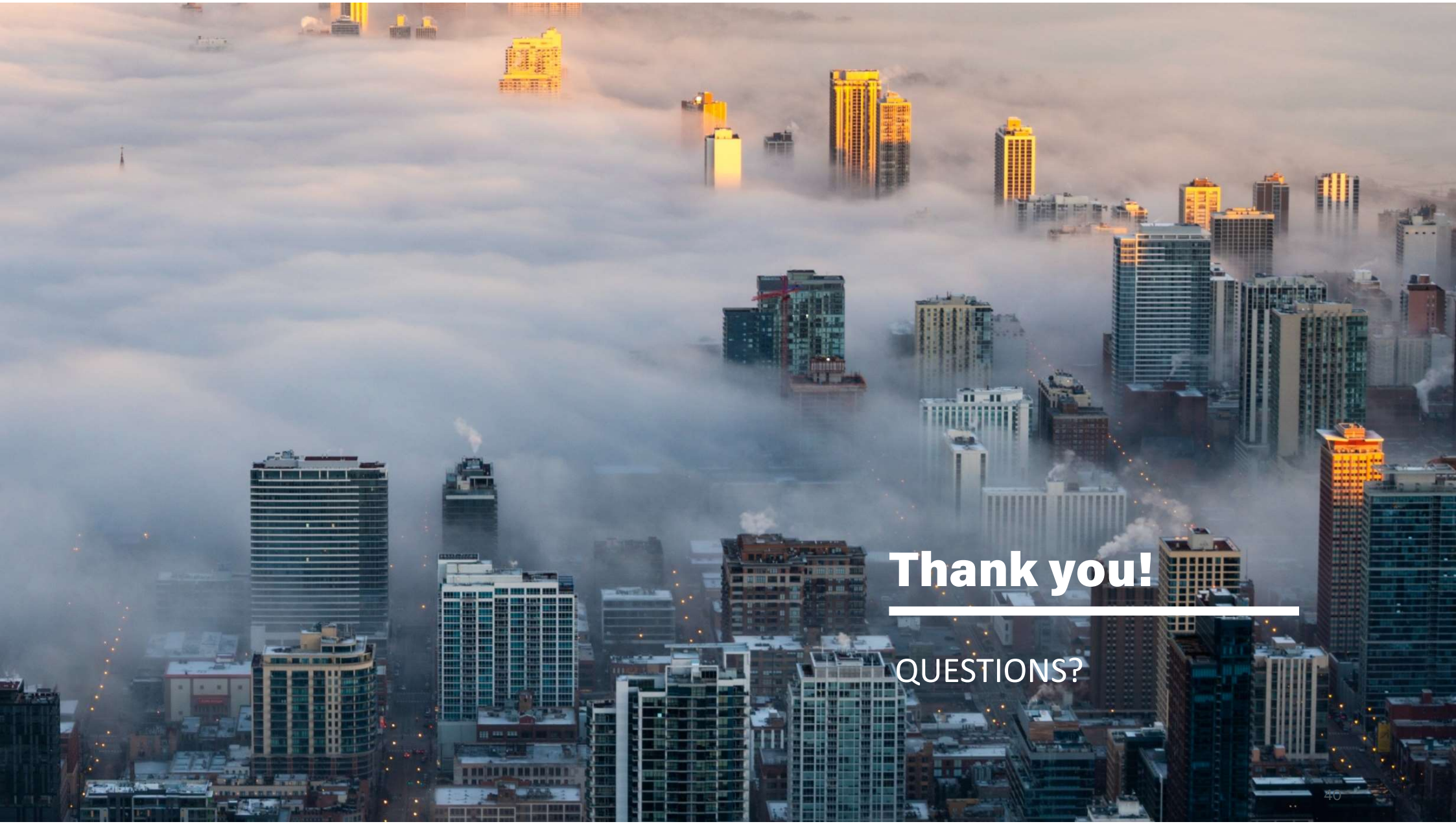
2. Involve external stakeholders in future cases studies design

3. Expand tenants' perspective within the in-shop EER.

4. Explore other leasing structures as a solution for in-shop scope barriers

6. Validate findings in other retail typologies.

07


Thank you!
QUESTIONS?