



What matters when? - A comprehensive literature review on decision criteria in different stages of the adaptive reuse process

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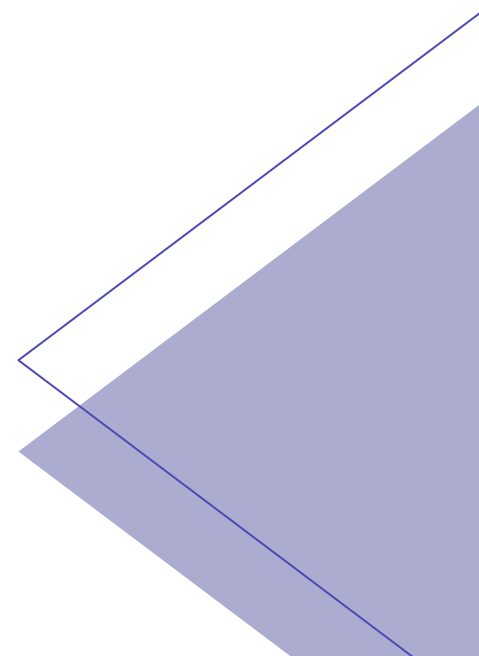
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The Problem

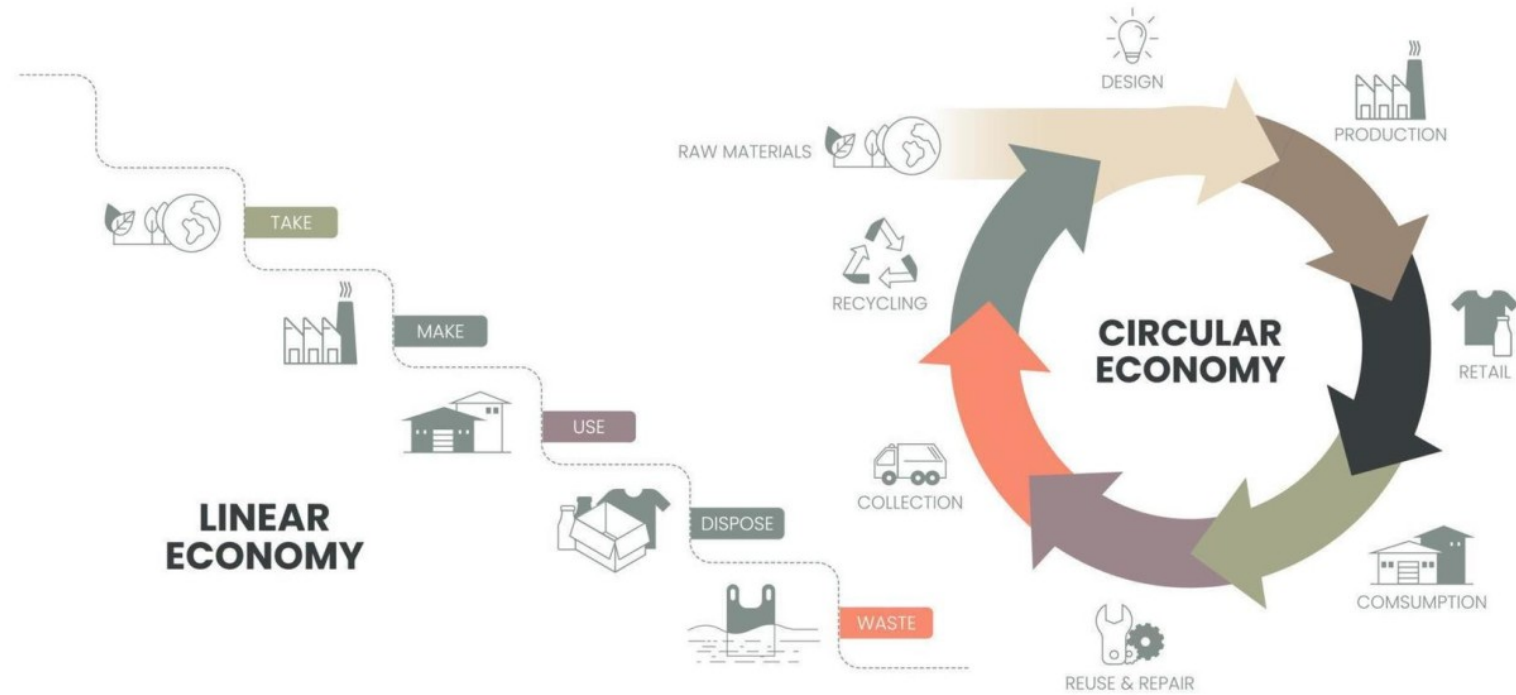
- Buildings worldwide account for:
- **40%** of the worlds waste
- **40%** of the material resources
- **33%** of all human induced emissions

- The average lifetime of a building is **39** years
- Most common reason for building demolition
– **functional /economic obsolescence**



Towards a circular economy

THE DIFFERENCE BETWEEN LINEAR AND CIRCULAR ECONOMY



Circular Built Environment

- Circular Economy Action Plan (EU)
- Nederland Circulair 2050 (NL)
- Circular Built Environment = **Adaptive Reuse**



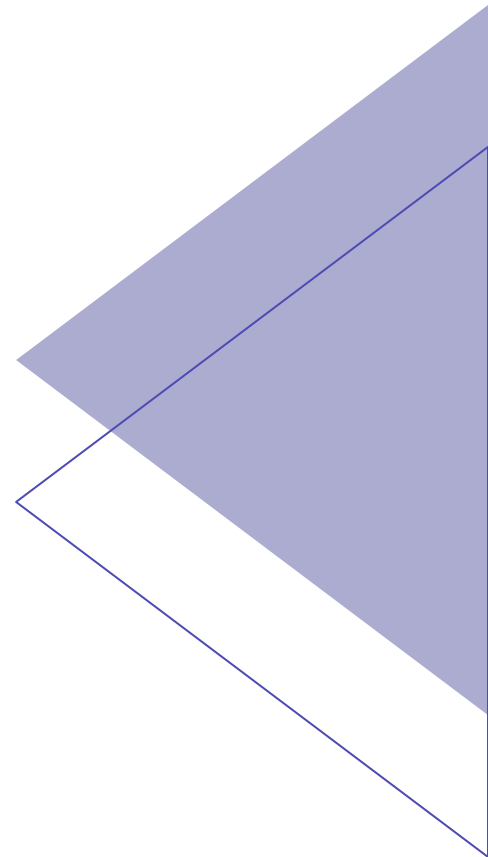
A circular economy in the Netherlands by 2050

A summary of the commitment and priorities of the government of the Netherlands

Adaptive Reuse

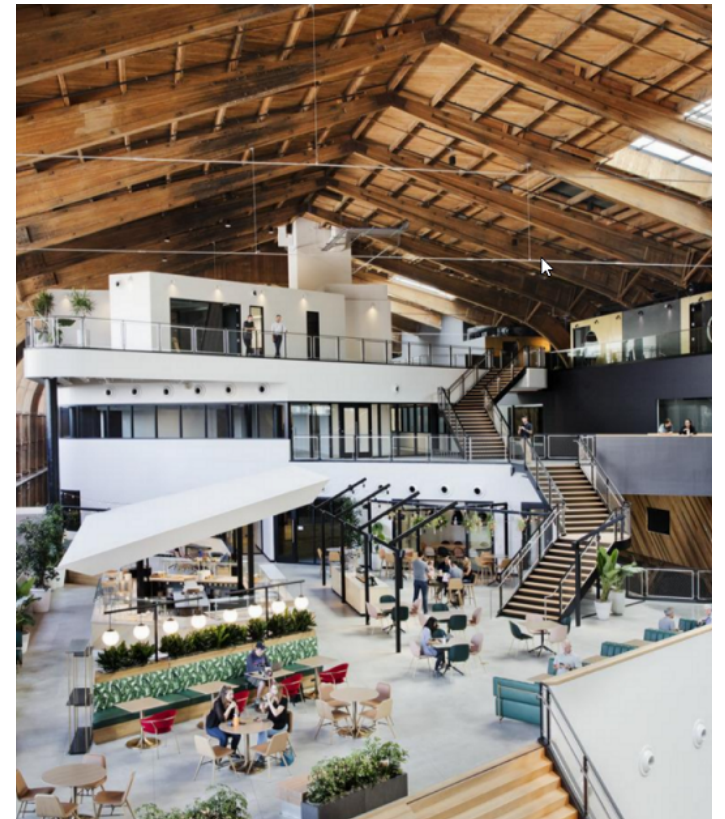
Functional obsolescence – changing the function and reusing the building!

Adaptive Reuse: *“process of converting building for a new use, different from the initial aim of its construction”*

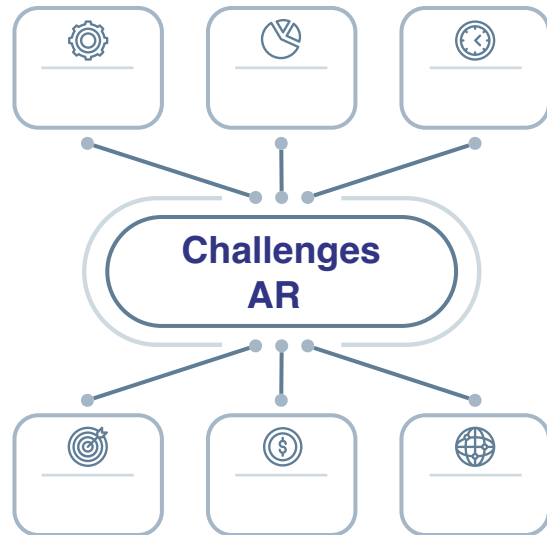


Benefits of adaptive reuse

- *Preserving embodied energy*
- *Reducing operational energy*
- *Reducing construction waste, material consumption, raw materials*



Challenges arise



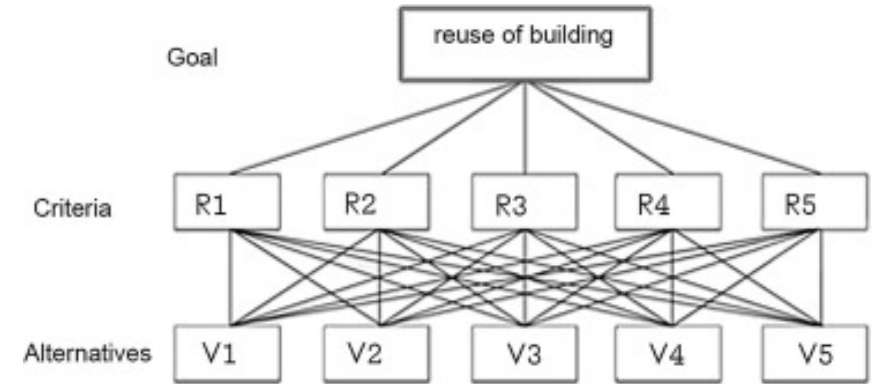
- Building regulation – changing function
- Higher risk for the return on investment
- Cost and time overruns
- Structural defects
- gentrification
- Technical challenges
- Functional / layout challenges
- Lack of guidance

decision making process

- **Complex**
- Variety of stakeholders involved (public-private)
- A lot of (contradictory) decision criteria
- Economic viability
- Difficulty in establishing a sense of place and identity
- -> Multi Criteria Decision Making Models



Multi Criteria Decision Making Model for AR

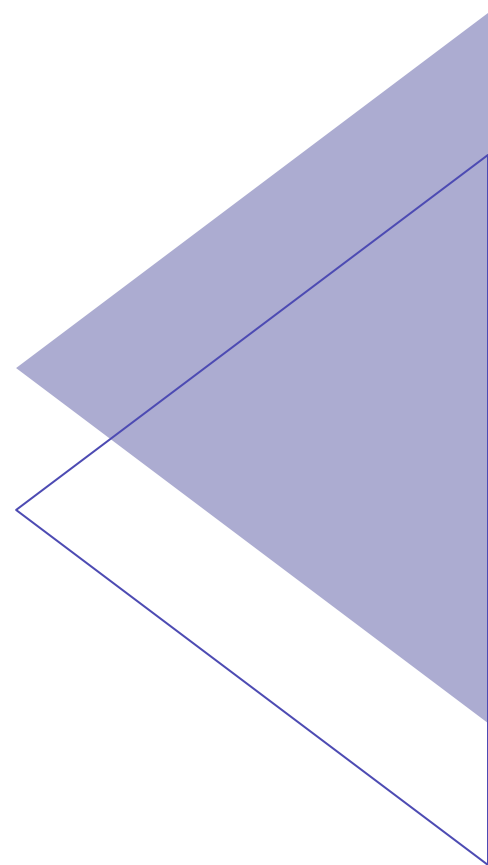


- No consensus on criteria
- No consensus on what tool
- Specific to situation
- Alternatives are too broad or too specific
- Most models don't consider the **whole AR process**
- Focus on **circularity** is lacking
- Lack of validation

Research Question & Aim

RQ: *What are the criteria in decision making for the adaptive reuse of buildings during the different phases of the AR process?*

Aim: *provide a state-of-the-art overview of the decision criteria for adaptive reuse throughout the AR process, in order to identify areas for future research.*



Research Methodology

- **Integrative literature review**
 - *“Useful tool for synthesizing a conceptual model for an emerging concept”*
- **Systematic search approach**
 - Iterative 15 step model
- **PRISMA-P method for selecting sources**
- Systematic screening process
- **Reflexive thematic analysis**
 - PESTLE framework
- **AR process model** (Arfa et al., 2022)



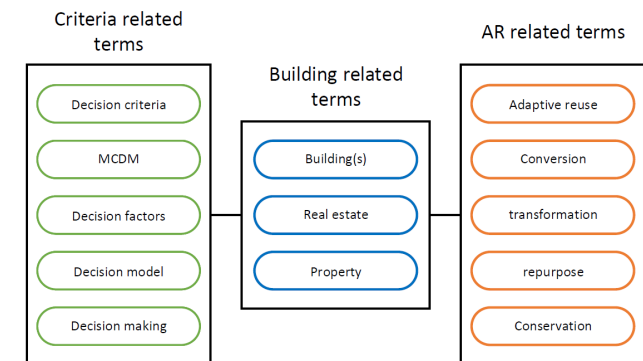
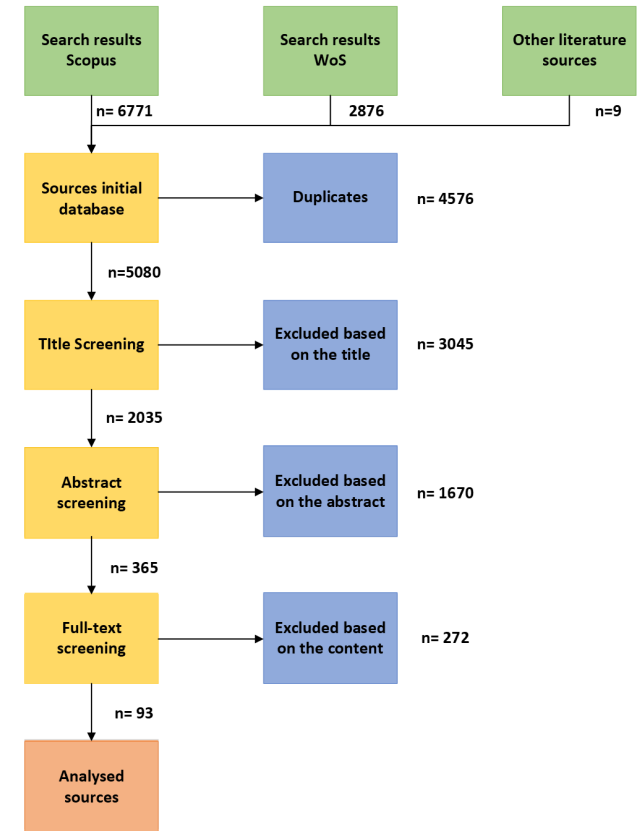
Screening process

- **Initial database:** 9656 publications
 - Brought back to 94
- **PRISMA-P method:**
 - Removing duplicates
 - Title screening
 - Abstract screening
 - Full-text screening
- Focus on **building level**

Following definitions for screening were used:

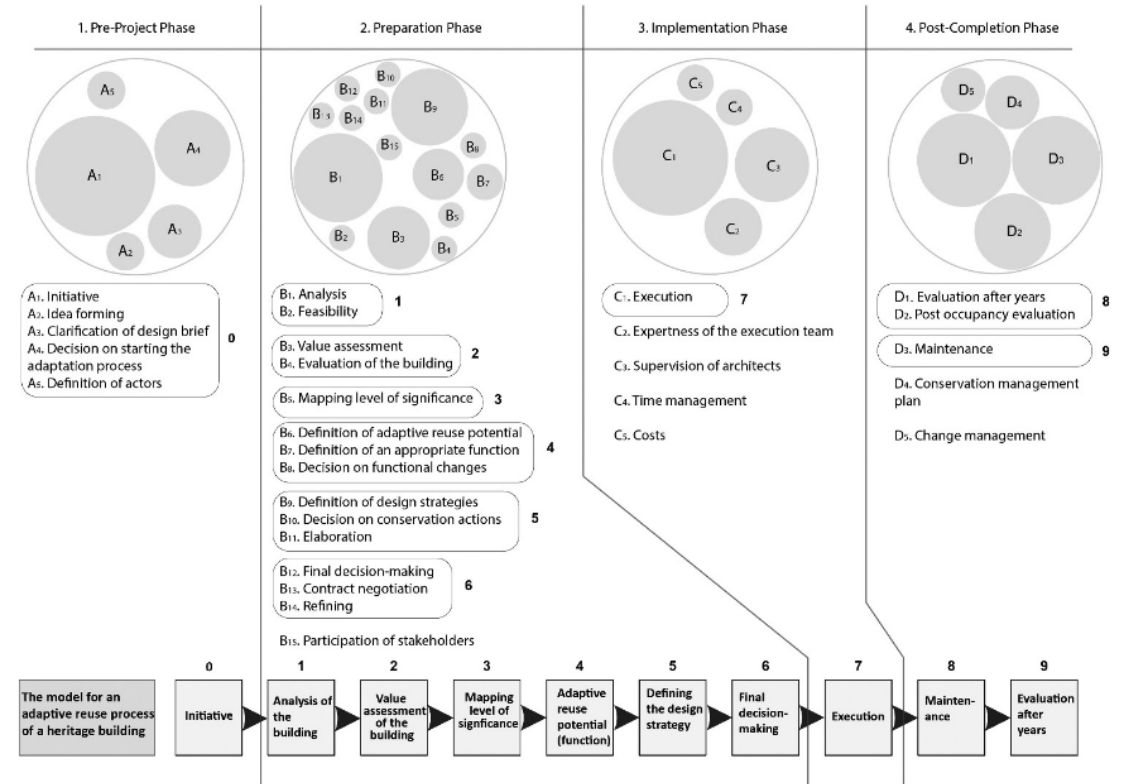
Adaptive reuse: "The process of converting the function of an existing building into another, which is substantially different from that function, in which the building was originally designed for" (function change)

Criteria: "A principle or standard by which something may be judged or decided" (broad definition)



Integrative analysis

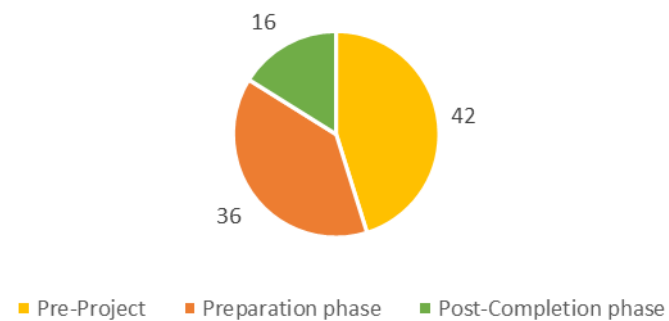
- **Thematic reflexive analysis (Miro)**
 - Hierarchical form
 - MAVT approach (objectives, criteria)
 - PESTLE
- **AR process model (Arfa et al., 2022)**
 - Distinct phases within the AR process
 - Implementation phase was excluded



Results

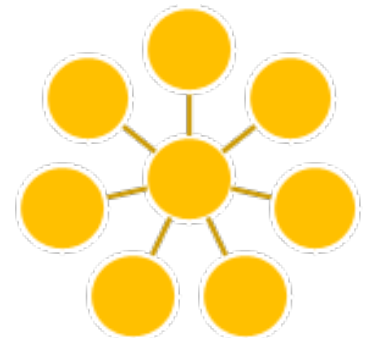
- 94 publications over 3 phases (pre-project, preparation, and post-completion phase)
- A lot of similarities between phases
- Most repeated categories are economic and architectural / physical

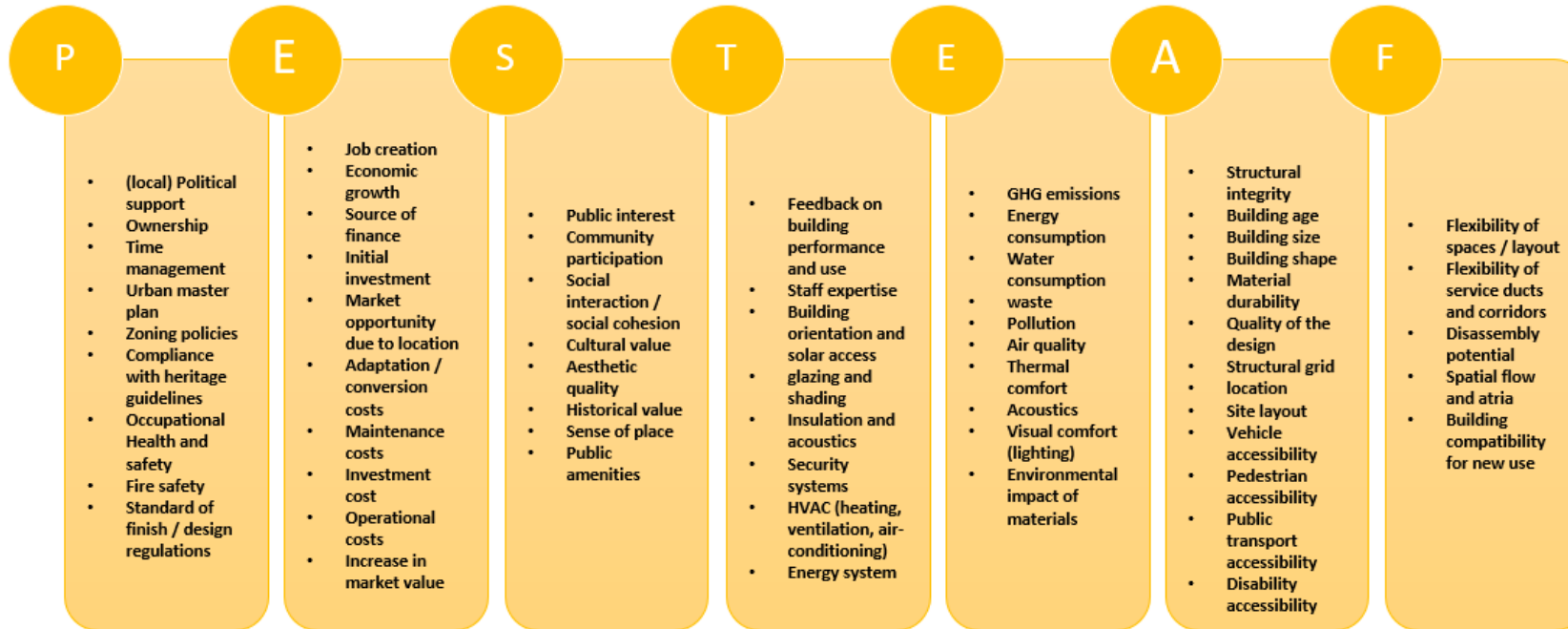
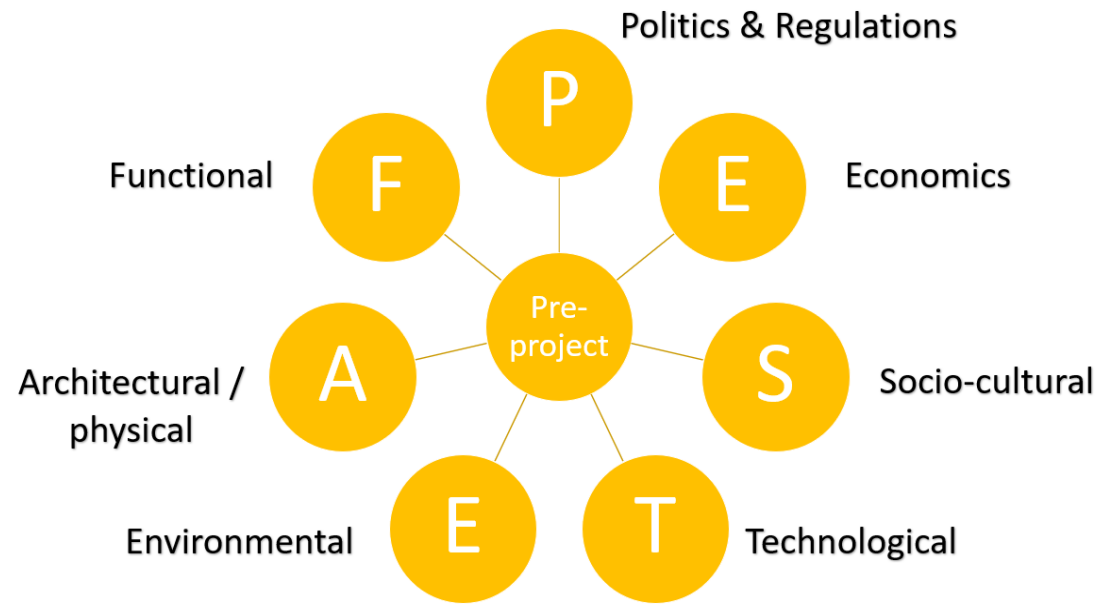
The number of reviewed publications per AR phase



Pre-project phase

- **Central question** in this phase: Should the building be preserved, reused, or demolished?
- **Publications in this phase (42):**
 - criteria formulation
 - Measuring adaptability / adaptive reuse potential
- **Thematic reflexive analysis resulted in:**
 - 7 categories
 - Politics and Regulations, Economic, Socio-Cultural, Technological, Environmental, Architectural / physical, Functional
 - 30 objectives
 - 65 criteria
- **Most repeated criteria:**
 - Market opportunity due to location
 - Flexibility of spaces / layout
 - Structural integrity

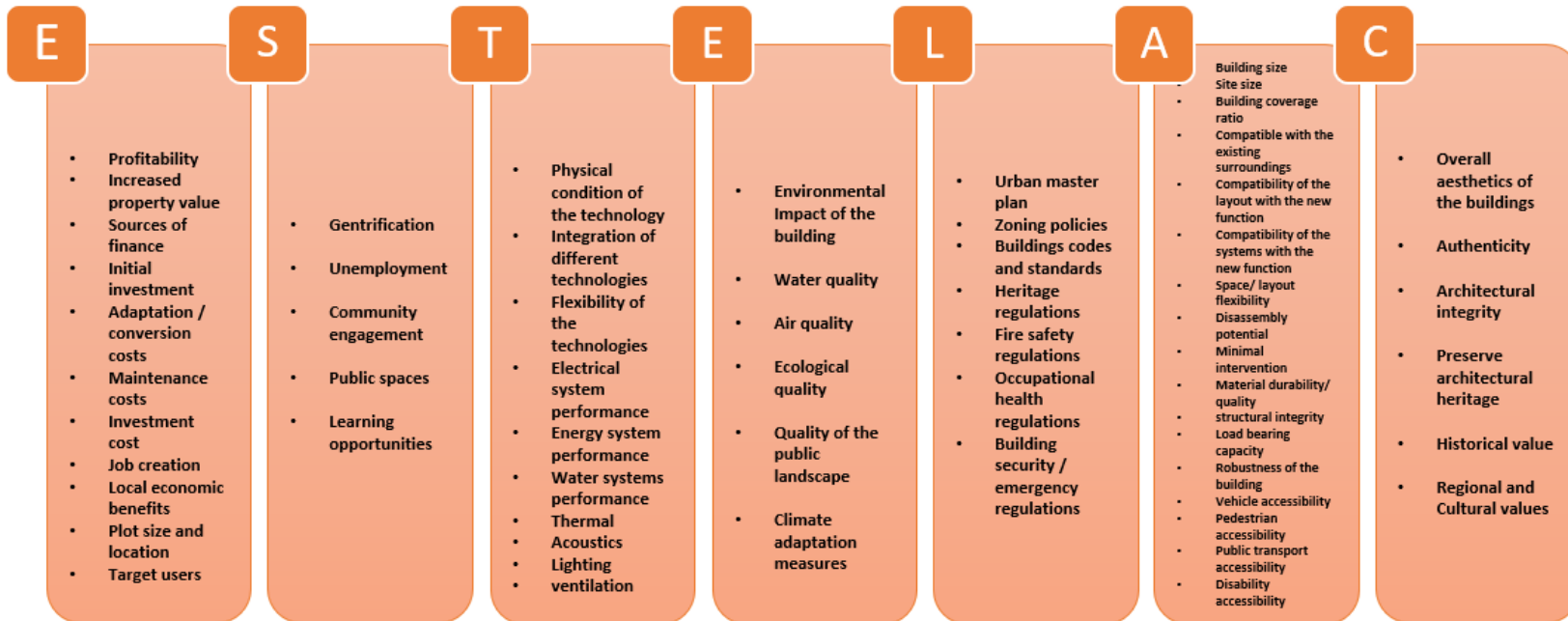
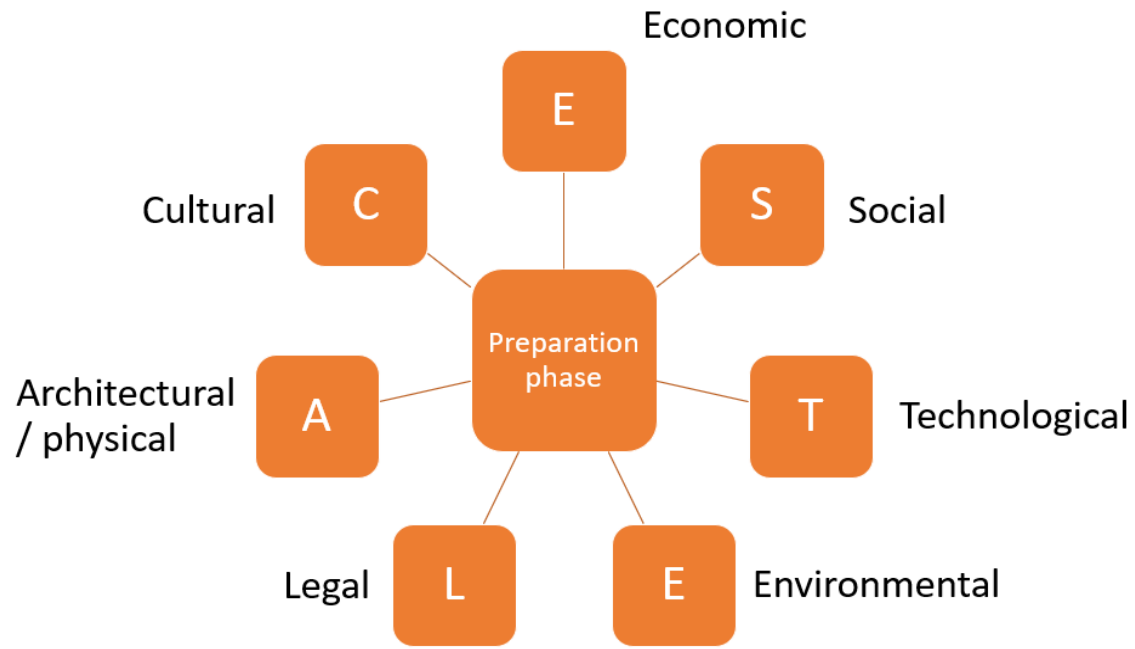




Preparation phase

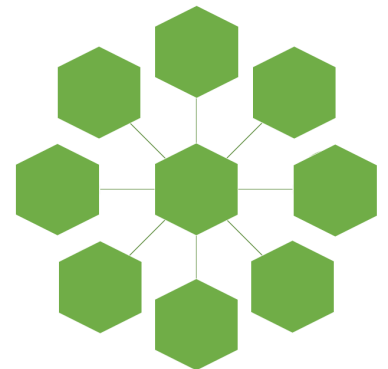
- **Central question** What is the best option for adaptive reuse?
- **Publications in this phase (36):**
 - Multi-criteria decision making between adaptive reuse options
- **Thematic reflexive analysis resulted in:**
 - 7 categories
 - Economic, Social, Technological, Environmental, Legal, Architectural / physical, Cultural
 - 25 objectives
 - 64 criteria
- **Most repeated criteria:**
 - Compatibility with the existing surroundings
 - Community Engagement
 - Local economic benefits

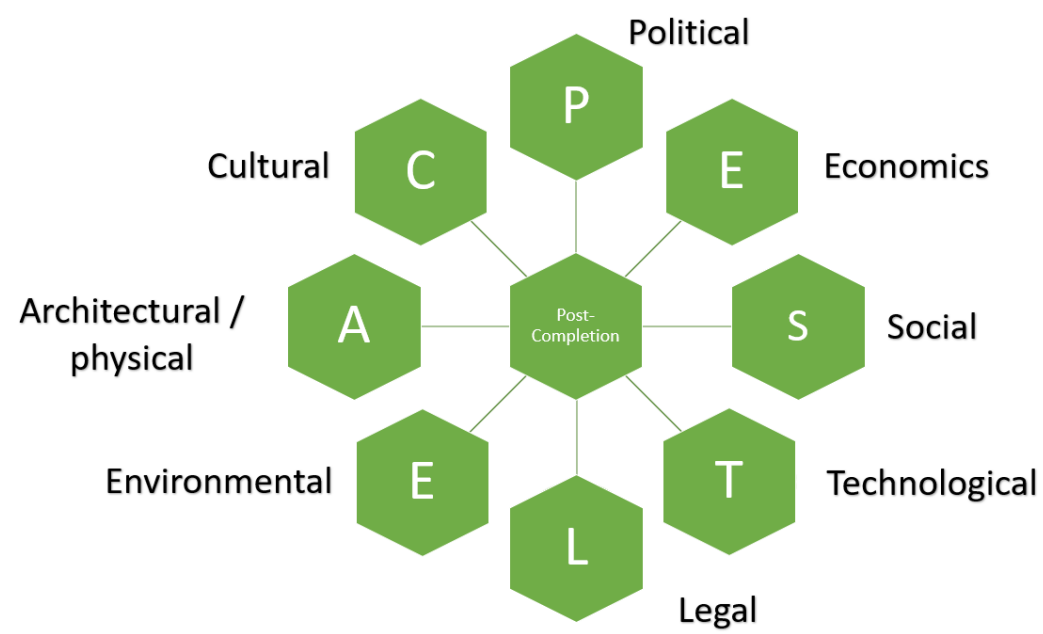




Post-completion phase

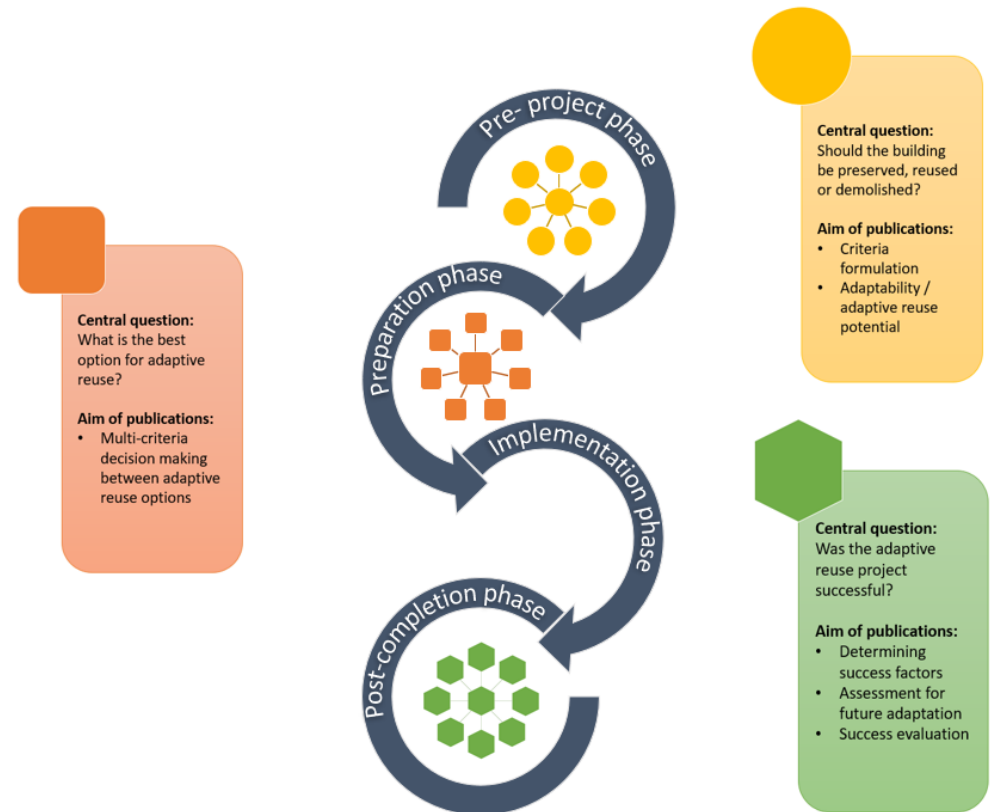
- **Central question** Was the adaptive reuse project successful?
- **Publications in this phase:**
 - Determining success factors
 - Assessment for future adaptation
 - Success evaluation
- **Thematic reflexive analysis resulted in:**
 - 8 categories
 - Political, Economic, Social, Technological, Legal, Environmental, Architectural / physical, Cultural
 - 30 objectives
 - 61 criteria
- **Most repeated criteria:**
 - Cultural value
 - Flexibility of spaces / layout
 - Return on investment





Interrelationships and contrasts

- Difference in the aim of the publications



Discussion

- Lack of publications in the implementation phase
- Weighting of the criteria and way of measuring might differ between phases
- The decision options for adaptive reuse are either really broad (functional use) or really specific (specific design option)
- Lack of specific environmental criteria focusing on health, well-being and biodiversity

Conclusion

- **The aim of this paper:** provide a state-of-the-art overview of the decision criteria for adaptive reuse throughout the AR process, in order to identify areas for future research.
- Outcomes can serve as a **resource** for future multi-criteria decision-making approaches
- Decision criteria show **a lot of similarities** between phases
- The most repeated decision criteria correspond to **economic** and **architectural / physical** categories

Recommendations for further research

- More research in the **differences of weighting and measurement** of the criteria between phases
- More research into the decision criteria in the **implementation phase**
- Alternatives and options considered in the multi criteria decision making models for adaptive reuse should consist of **more holistic scenarios** that provide a general overview of what is possible when pursuing adaptive reuse.
- **Environmental decision criteria** should be considered from a **broader perspective** looking at: biodiversity, climate adaptation, soil quality and health and well-being.

What's next?

- Developing circular adaptive reuse scenarios
- Developing a multi-criteria decision-making model that incorporates the decision criteria and the circular adaptive reuse scenario
- Apply the MCDM model to multiple case studies in the Reincarnate project
- Validate the model according to multiple validation methods



Thank you!

Relevance

- **Scientific relevance**
 - Few publications have considered the decision-making process for adaptive reuse as a whole
 - A lack of a uniform vision surrounding the decision criteria for adaptive reuse throughout the whole adaptive reuse process
 - A lack of a comprehensive overview of decision criteria for adaptive reuse throughout the AR process
- **Societal relevance**
 - Lack of guidance and participation in the AR decision-making process
 - The importance of adaptive reuse as a circular strategy towards a circular economy

