



Prioritizing Residential Spaces for Inclusive and Sustainable Multigenerational Housing: A Spatial Priority Matrix to Support Ageing-in-Place

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Dr. Van-Duc, Tran

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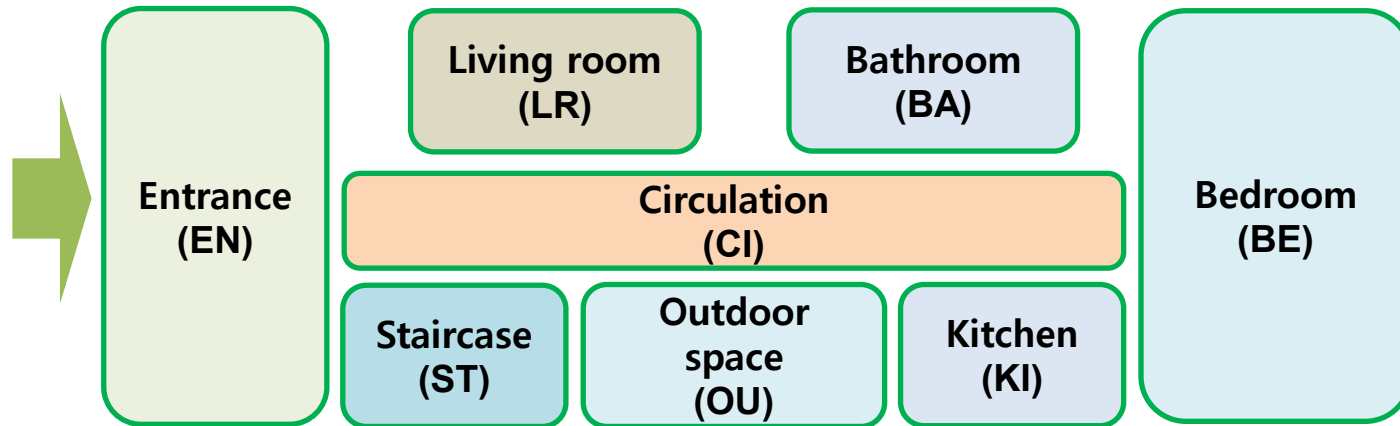
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1 INTRODUCTION

1.1. Background & Purpose

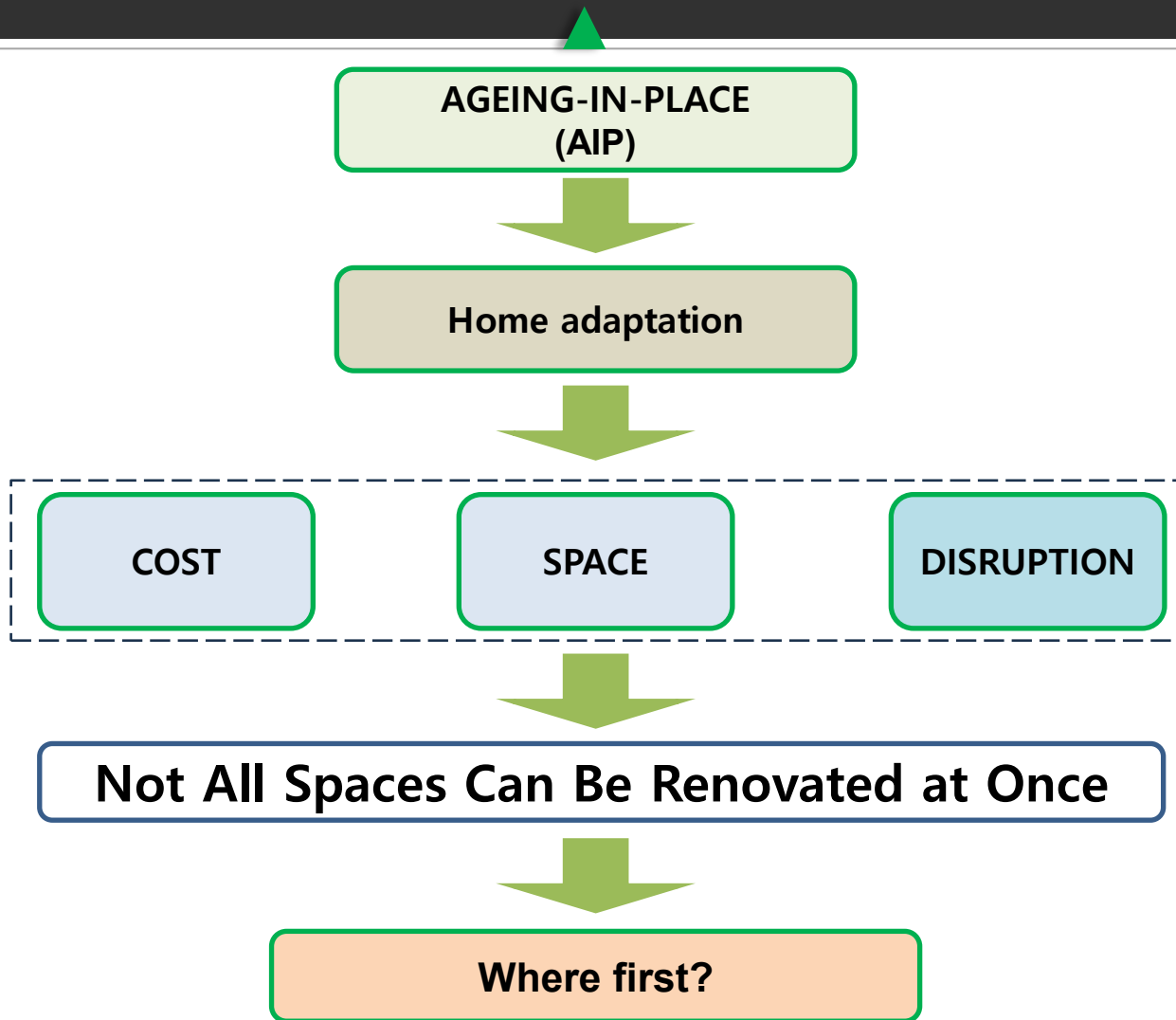
1.2. Research gap

1.3 Research Objective &
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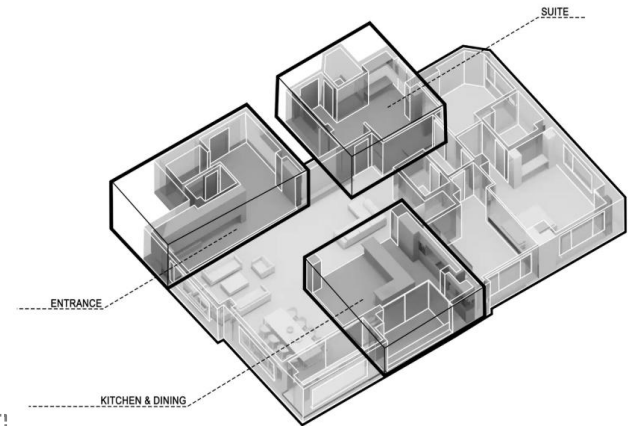
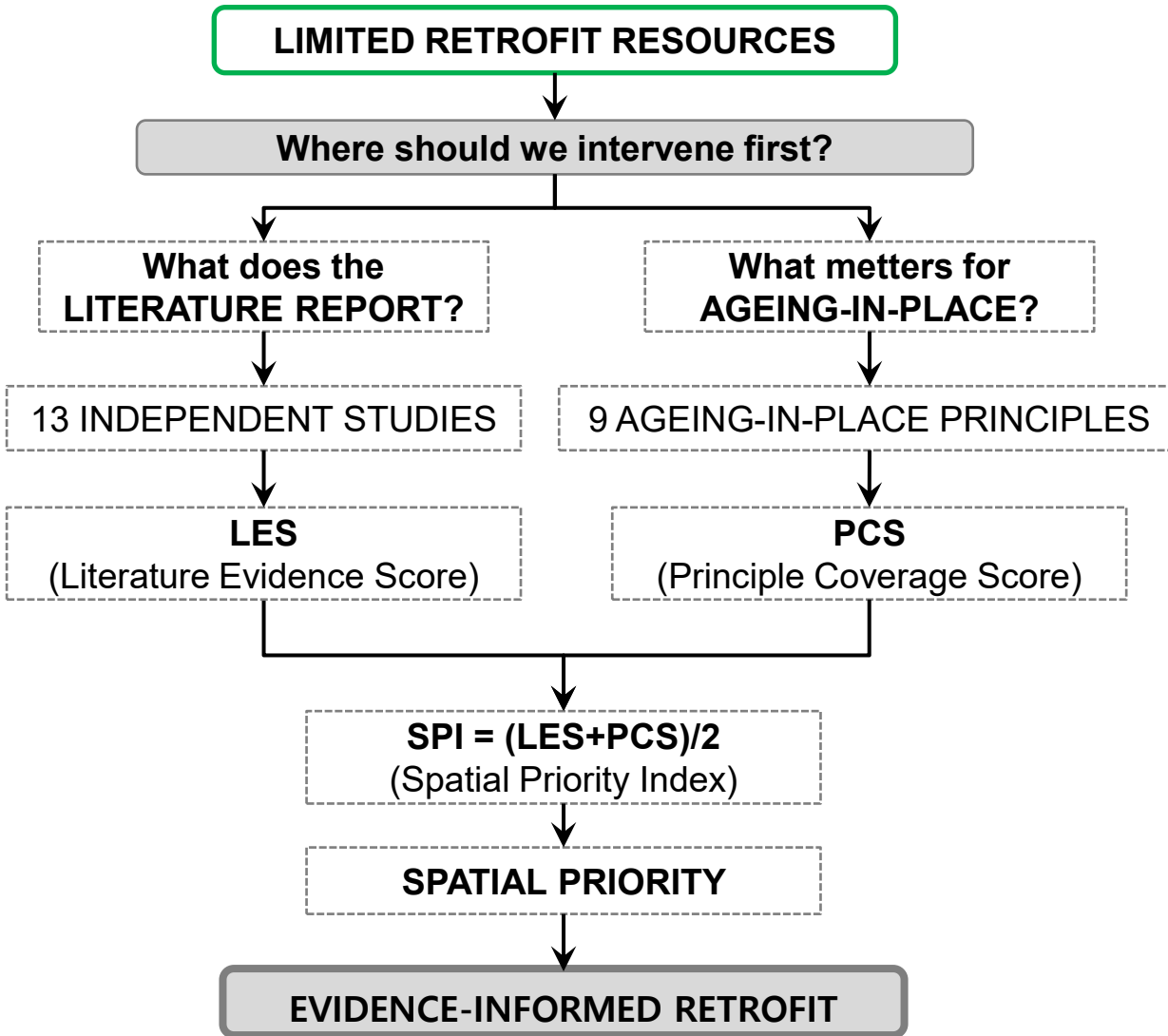


Where should we intervene first?

Ageing-in-place with limited retrofit resources



The challenge is not only what to modify, but where to intervene first



WHY SPATIAL PRIORITISATION MATTERS?

- Limited renovation resources
- Multiple ageing-in-place needs
- Shared multigenerational spaces

To identify where housing adaptations should be prioritised before selecting specific retrofit interventions

From Housing Assessment to Spatial Prioritisation

EXISTING RESEARCH

- Housing condition assessment
- Age-friendly design criteria
- Renovation decision support

WHAT needs improvement?

RESEARCH GAP

- (?) Limited explicit spatial ranking
- (?) Unclear intervention sequence
- (?) Limited resources for adaptation

WHERE should we intervene first?

RESEARCH OBJECTIVE

To establish evidence-informed priorities among eight residential spaces for ageing-in-place

EN

LR

KI

BE

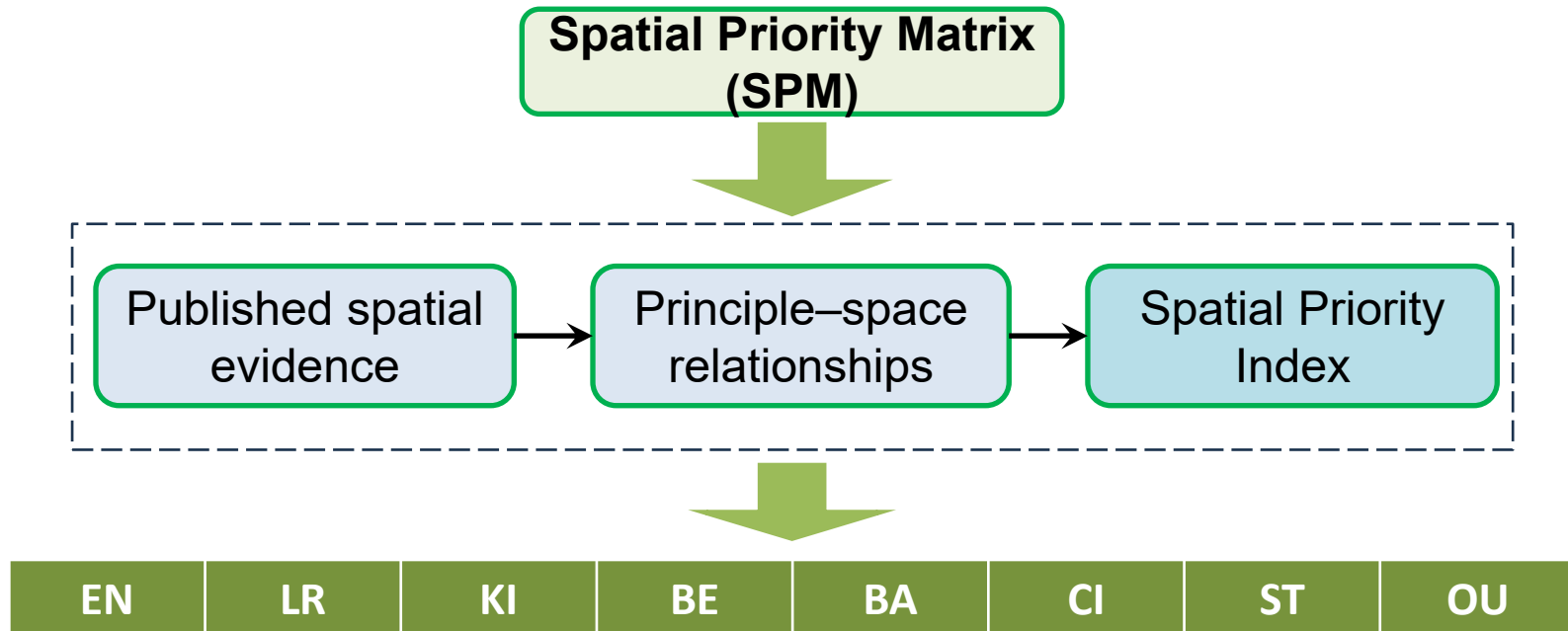
BA

CI

ST

OU

Existing approaches identify what matters; this study examines where to prioritise intervention



From spatial evidence and design principles to evidence-informed retrofit priorities

Spatial Priority Matrix (SPM): Scoring Framework

LITERATURE EVIDENCE

LES

13 independent studies

Direct evidence (D) = 2

Supporting evidence (S) = 1

No evidence = 0

$$LES_j = \frac{2D_j + S_j}{2N}$$

N = 13 studies

PRINCIPLE COVERAGE

PCS

9 ageing-in-place principles

Strong relationship (H) = 2

Supporting relationship (M) = 1

Insufficient relationship = 0

$$PCS_j = \frac{2H_j + M_j}{18}$$

18 = 2 × 9 principles

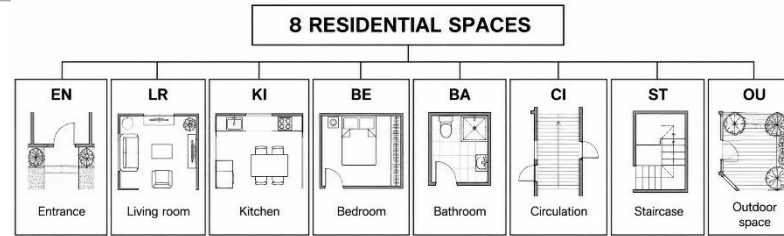
SPATIAL PRIORITY INDEX (SPI)

$$SPI_j = \frac{LES_j + PCS_j}{2}$$

Equal weighting: LES 50% + PCS 50%

SPATIAL PRIORITY RANKING

8 Residential Spaces → Evidence-informed Retrofit Priorities



Study	EN	LR	KI	BE	BA	CI	ST	OU
Cook et al. (2005)	D	S	—	D	D	D	D	—
Hutchings et al. (2008)	D	D	D	D	D	S	D	D
Safran-Norton (2010)	S	—	—	—	D	S	S	—
Hwang et al. (2011)	D	—	—	—	D	S	D	S
Hwang et al. (2014)	S	—	D	—	D	S	S	—
James & Saville-Smith (2018)	S	—	D	D	D	S	S	D
Serrano et al. (2019)	S	D	D	D	D	D	D	—
Mercader et al. (2020)	S	—	—	—	—	D	—	D
Serrano et al. (2022)	D	D	D	D	D	D	D*	D
Ptak et al. (2024)	D	D	D	D	D	D	S	S
Green et al. (2024)	S	—	D	D	D	S	S	—
Wang et al. (2025)	D	—	—	—	D	S	S	—
Washington et al. (2025)	D	S	D	D	D	D	D	D
Direct evidence, D	7	4	8	8	12	6	6	5
Supporting evidence, S	6	2	0	0	0	7	6	2
LES	0.769	0.385	0.615	0.615	0.923	0.731	0.692	0.462

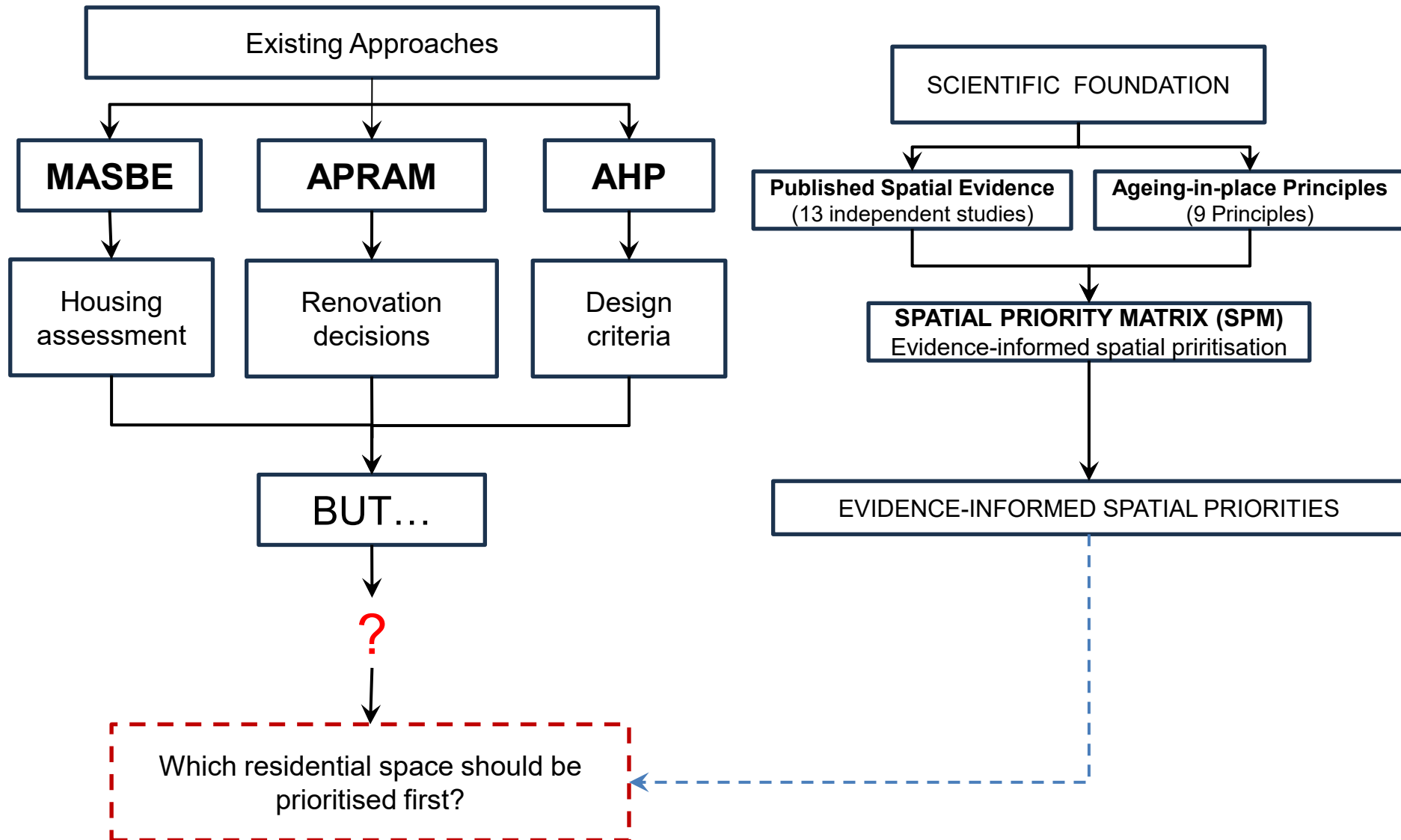
$$LES_j = \frac{2D_j + S_j}{2N}$$

where D_j is the number of direct-evidence studies

S_j is the number of supporting studies

and $N = 13$ independent studies

2 SCIENTIFIC BASIS



From housing assessment and design criteria to evidence-informed spatial prioritisation

Spatial Priorities: What Do the Results Reveal?

01 0.782 CIRCULATION	02 0.740 BATHROOM	03 0.690 ENTRANCE
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INTERMEDIATE RANGE		LOWEST RELATIVE SPI
Kitchen	0.641	0.498
Staircase	0.624	Living room
Outdoor space	0.620	<i>Lower relative priority within this matrix, not an absence of design importance</i>
Bedroom	0.613	

Literature recurrence ≠ Multidimensional relevance

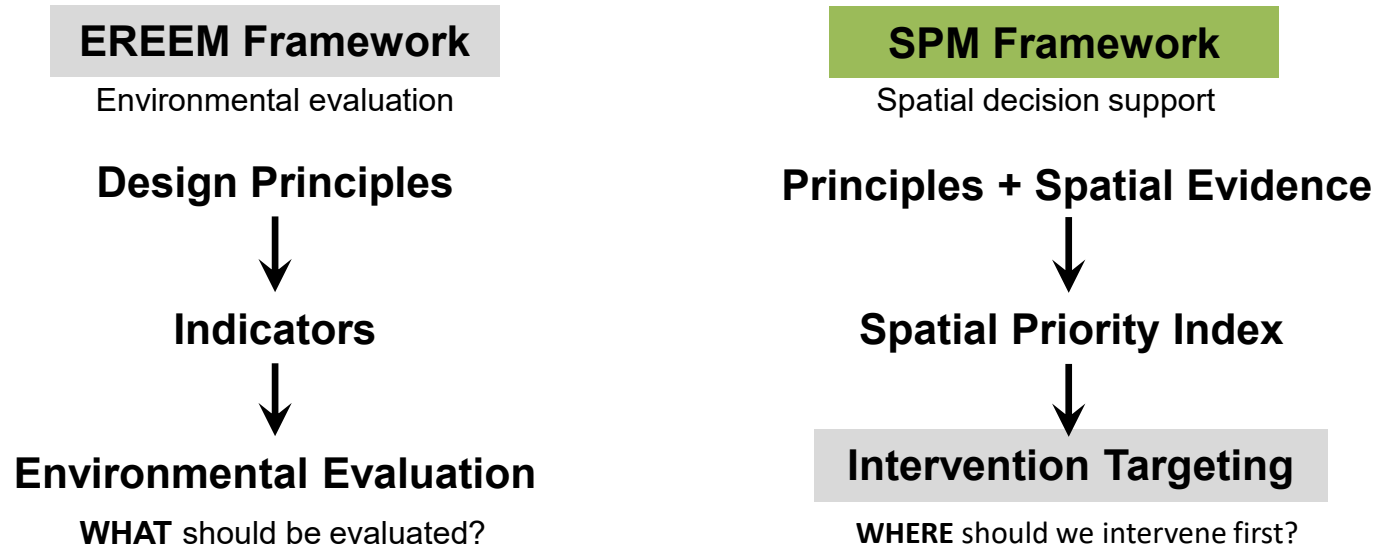
Spatial priority requires the integration of both LES and PCS

Spatial priority cannot be determined by intervention frequency alone

Circulation and outdoor spaces demonstrate the broadest coverage of ageing-in-place principles



From Environmental Evaluation to Spatial Prioritisation



From EVALUATION → SPATIAL DECISION Support

SPM extends rather than replaces EREEM



SPM translates environmental principles into evidence-informed spatial priorities



Practical Implementation and Limitations

PRACTICAL IMPLEMENTATION

Spatial Priority (SPI)



Technical & Economic Feasibility



Household Consultation



Specific Retrofit Intervention

METHODOLOGICAL LIMITATIONS

Selected literature

13 independent studies; purposive and heterogeneous evidence base

Ordinal scoring

2–1–0 coding; not a measure of effect size

Context-specific factors

Costs, structural feasibility, health, household composition and preferences are not directly included in SPI

Future validation

Testing with residents and professional assessments in multigenerational dwellings

HIGH SPI ≠ IMMEDIATE RENOVATION

SPM prioritises WHERE — feasibility and household needs inform HOW

Towards Inclusive and Sustainable Multigenerational Housing

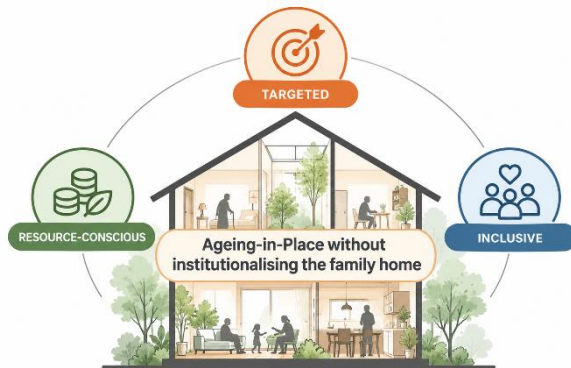


Key finding — highest spatial priorities

01
0.782
CIRCULATION

02
0.740
BATHROOM

03
0.690
ENTRANCE



Adaptation of existing multigenerational housing

PRACTICAL CONTRIBUTION

TARGETED

RESOURCE-CONSCIOUS

INCLUSIVE

Prioritising spatial interventions while preserving familiar domestic environments and shared family life

SPM identifies WHERE to intervene — not HOW to renovate

1. Circulation, bathroom, and entrance emerged as the strongest priorities, while the remaining spaces reflected different balances between intervention evidence and broader environmental relevance.
2. The SPM provides a transparent spatial-prioritisation layer between environmental assessment and retrofit selection.
3. For multigenerational housing, this supports targeted and resource-conscious adaptation while preserving domestic continuity and shared family life.



THANKS FOR YOUR ATTENTION



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